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WADD-TR-60-470, PART III

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AUTOMATIC RUNWAY PROFILE MEASURING INSTRUMENTATION AND RUNWAY PROPERTIES

PART III — BASE SURVEYS

TECHNICAL DOCUMENTARY REPORT WADD-TR-60-470, PART III

JULY 1963

AF FLIGHT DYNAMICS LABORATORY
AERONAUTICAL SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

Project No. 1367, Task No. 136701



Prepared under Contract AF 33(616)-7851
by

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PART III

FOREWORD

This report was prepared for the Vehicle Dynamics Division, AF Flight Dynamics Laboratory, Aeronautical Systems Division, Wright-Patterson Air Force Base, Ohio, by Midwest Research Institute. This research is part of a continuing effort to provide a more rational and reliable theoretical method for establishing design criteria in the specific area of shock and impact for flight vehicles which is part of the Air Force Systems Command's Applied Research Program 750A, the Mechanics of Flight. The research work was accomplished under Air Force Contract No. AF33(616)-7851 initiated under Project No. 1367 "Structural Design Criteria," Task No. 136701, "Design Criteria for Ground Induced Dynamic Loads." The work was administered under the direction of the Aerospace Dynamics Branch, Vehicle Dynamics Division with Walter F. Dunn acting as project engineer.

This report covers work from February 1961 to December 1962. This report is Part III of a three part report, the others being Part I, "Equipment" and Part II "Equipment Trials."

The Aeronautical Systems Division as an in-house effort programmed the IBM 7090 digital computer, and reduced the data presented in this report. The following persons are responsible for this effort, Mr. Franklin E. Fisher, Mr. John E. Derrickson, Mr. Warren G. Smith, Mr. Jim N. Marable, and Mr. John P. Dollinger.

The author wishes to acknowledge the cooperation and assistance of Air Force personnel of the bases surveyed.

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ABSTRACT

Runway roughness data from surveys of runways, taxiways, and selected parking ramps of 17 Air Force bases in the United States of America are presented in the form of profile and power spectral density plots. Tabulated data and base maps are included to describe the length of the surveys and their location. The method used to calculate the power spectral density is enclosed.

PUBLICATION REVIEW

This report has been reviewed and is approved.

FOR THE COMMANDER



WALTER J. MYKYTON
Actg. Associate Director
Vehicle Dynamics Division
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I. INTRODUCTION

The high speed of modern flight vehicles requires careful design of the flight vehicle structure. A flight vehicle analysis for ground operations requires knowledge of the frequency phasing and amplitude of the loads. Accurate predictions of the loads imposed during ground operation have not been possible because of the limited knowledge of the characteristics of the surfaces used by a flight vehicle during its operational life. The power spectral density calculated from these surfaces indicates how the average power or amplitude is distributed with reduced frequency. When adequate description of the surfaces have been obtained, methods may be developed to predict loads during ground operation of flight vehicles.

II. EQUIPMENT AND PROCEDURE

Adequate description of the many different pavement types and surface condition requires a vast amount of profile information. In the course of this project, nearly 2 million profile height readings were recorded from 187 miles of runways and taxiways. Special automatic equipment was used to efficiently measure and record the profile data in a form compatible with high speed digital computers.

The runway profile instrumentation system used in this project is composed of a collimator and a profile recorder (see Figure 1). The collimator is used to project a well-defined beam of light down the runway to establish a horizontal reference line. The profile recorder is towed down the surface to be measured, recording the profile elevations.

Before initiating the survey of the bases, a special analog profile recording unit was added to the runway instrumentation system (see Figure 2). A standard strip chart was used to plot the vertical profile indicated by a potentiometer mounted on the sensing head. The chart is advanced every 6 inches of travel on the runway by a stepping motor. The drive between the motor and the recorder is designed to produce a horizontal scale of 1 inch = 100 feet of runway. The vertical scale is 1 inch = 1 foot change in elevation. The analog plot proved to be extremely useful to the survey crew in monitoring the operation of the entire unit.

A surveying procedure was developed to obtain as much information as possible from a limited number of survey runs. Cross-runs, or lines of survey

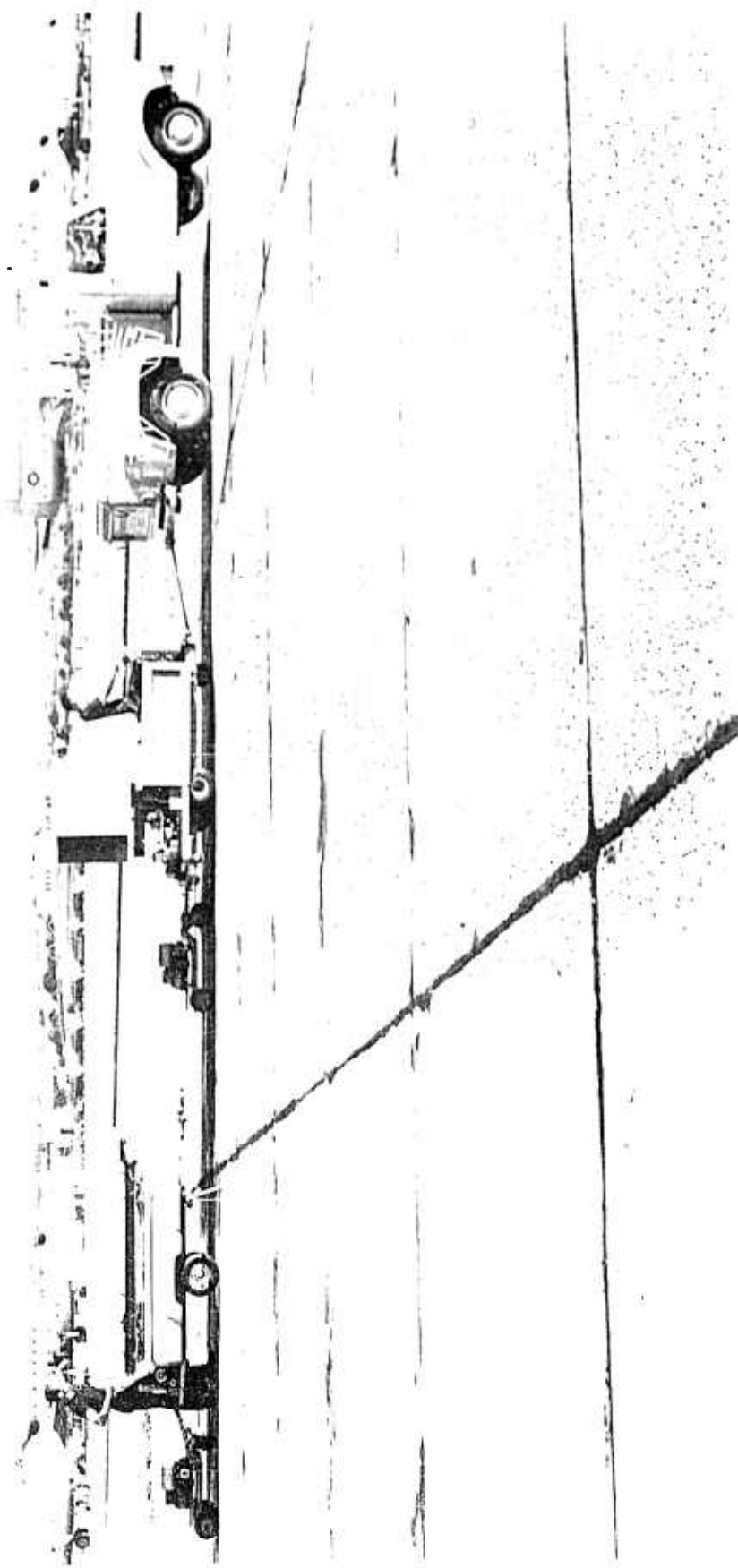
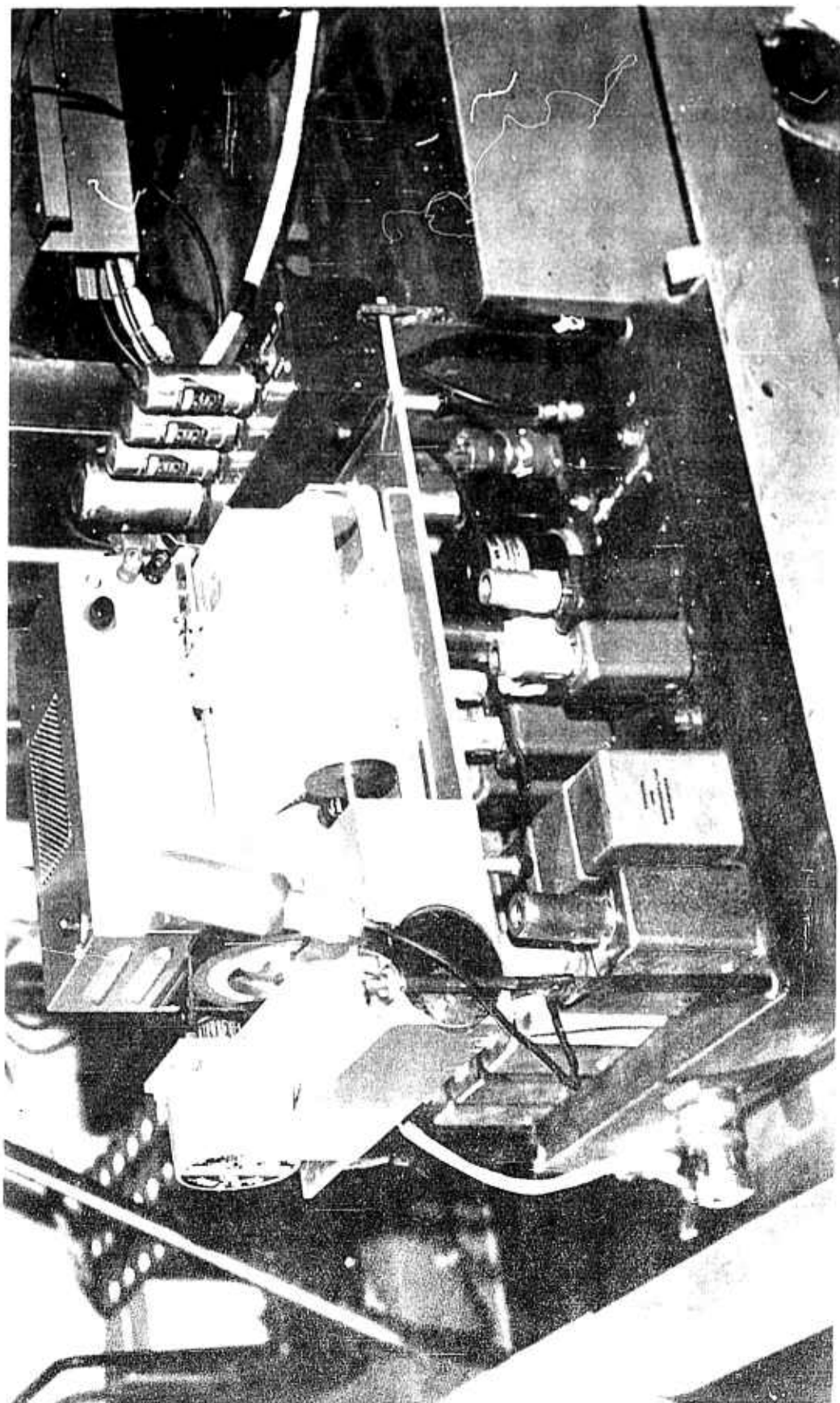


Figure 1 - Runway in the foreground. Instrumentation.



perpendicular to the center line of the runway or taxiway, were made at both ends and adjacent to the 1,000-ft. runway markers. These profiles show the drainage slope. The final step consisted of three runs; center line, right hand side, and left hand side the length of the surface. The distance from the seam at the threshold to the starting point of each longitudinal run was recorded to permit repeating the survey at a later date. The distances from the start of each longitudinal run to the intersection with the cross runs were also recorded. These distances were measured by a switch on the profile follower wheel advancing a counter as an odometer at 6-in. intervals to aid in measuring the survey distances. The odometer count locating the center line of the surface on cross runs, as well as the intersection points and total length of each run, is listed in Appendix IV. This cross reference between the three longitudinal surveys and the cross runs can be used to reconstruct the surface profile in three-dimensional form as shown schematically in Figure 3.

The runway roughness instrumentation is similar to conventional equipment in that the accuracy of the survey depends on the accuracy in establishing the horizontal reference. A standard surveying equipment spirit level with an accuracy to within 20 sec. of arc is used to indicate the horizontal. Before initiating the survey of each base, an identical portion of a runway was surveyed in both directions. A comparison of the profile plots from the profile chart recorder indicated the repeatability of the entire system disclosed infrequent or random malfunctions which would not be encountered in routine check-out operation, and permitted a fairly accurate estimate of the slope error. Examination of the profile charts obtained from a number of these test runs disclosed a small error in the initial mounting of the level vial. The recorded slope was found to have an error of 2-3 in/1,000 ft. No attempt was made to improve this calibration under field conditions. A deviation in over-all slope would not change the power spectrum calculations. However, if an accurate vertical relationship between the survey paths is required, it can be obtained with the relationship established by the cross run.

III. DISCUSSION OF RESULTS

A general study of ground loading effects must be based on surface information. The 17 bases surveyed were chosen from all parts of the continental United States to provide a sampling of surface conditions. The raw profile data obtained have been processed by the computer facility at the Aeronautical Systems Division.

The power spectral density curves in Appendix I represent the roughness properties of the runways from a statistical standpoint. It has been noted that the power spectral density plots of some concrete surfaces show a

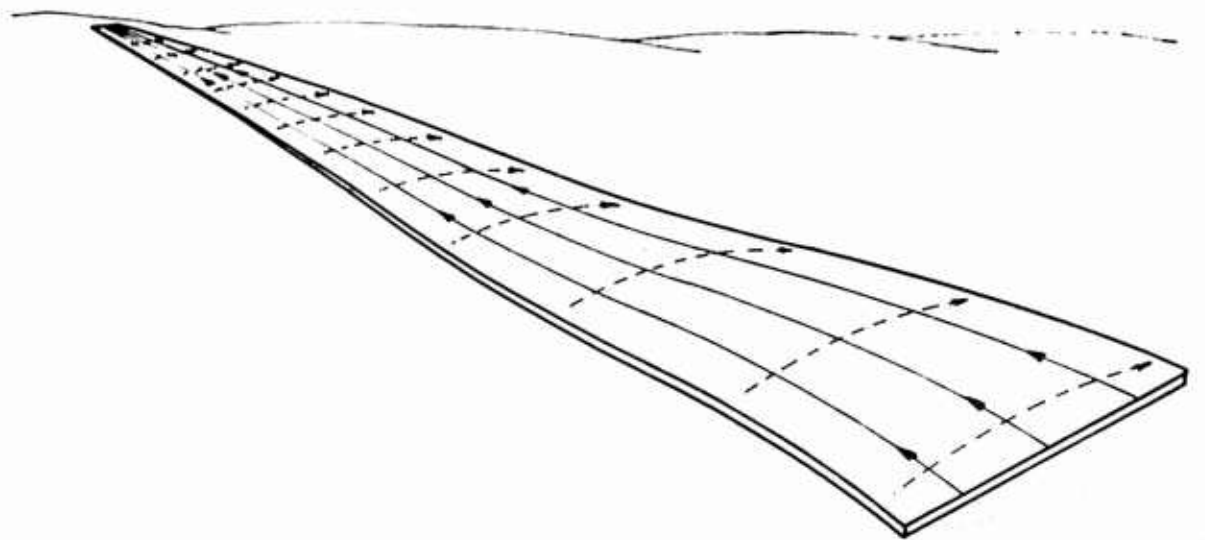


Figure 3 - Relationship between Cross Run Profiles and Longitudinal Profiles

peak or unusually high reading at a wavelength corresponding to the length of the slabs in the pavement. The tar strip at the joints appears as a high point on the profile which reoccurs at regular intervals. Power spectral density analysis of the profile data must interpret this occurrence as a surface undulation and shows it as such on the plot and often the second and third harmonics of the slab length disturbance can be seen on the plot. Another series of peaks, resulting from an occasional overshoot of the photoelectric sensor in maintaining its position at the center of the light beam, can be noted at extremely short wavelengths. Apparent profile undulation with a wavelength of 2 to 3 feet is produced from servo system characteristics coupled with a constant surveying speed.

Appendix II, scale plots of the profiles measured, shows the length, total change in elevation, maximum grade and length of the profile. These condensed profiles show the linear trend, profile end-point to end-point grade, the effect of which was removed from the power spectral density. Further the effect of the large amplitude low-frequency content of the profile, which biases the power spectral density value corresponding to the lowest plotted reduced frequency, can be qualitatively evaluated. The cross run profiles show the crown of the surface. The profiles of two 1,000-ft. surveys of parking ramps from each base are also included.

Further detailed information of the location and length of each survey is given in tabular form in Appendix IV. The information given for each longitudinal survey includes the designation of the surface, the location with respect to center line, the distance from the threshold joint to the starting point, and the odometer count at the intersection point of each cross run. The odometer count represents 6-in. intervals, divided by two to obtain feet. The last figure given is the total odometer count of the run or twice the length of the run in feet. Cross run information includes the location with respect to the end of the surface, the odometer count at the intersection of the cross run and the longitudinal center line of the surface and the final count or total length.

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APPENDIX I

POWER SPECTRAL DENSITY PLOTS

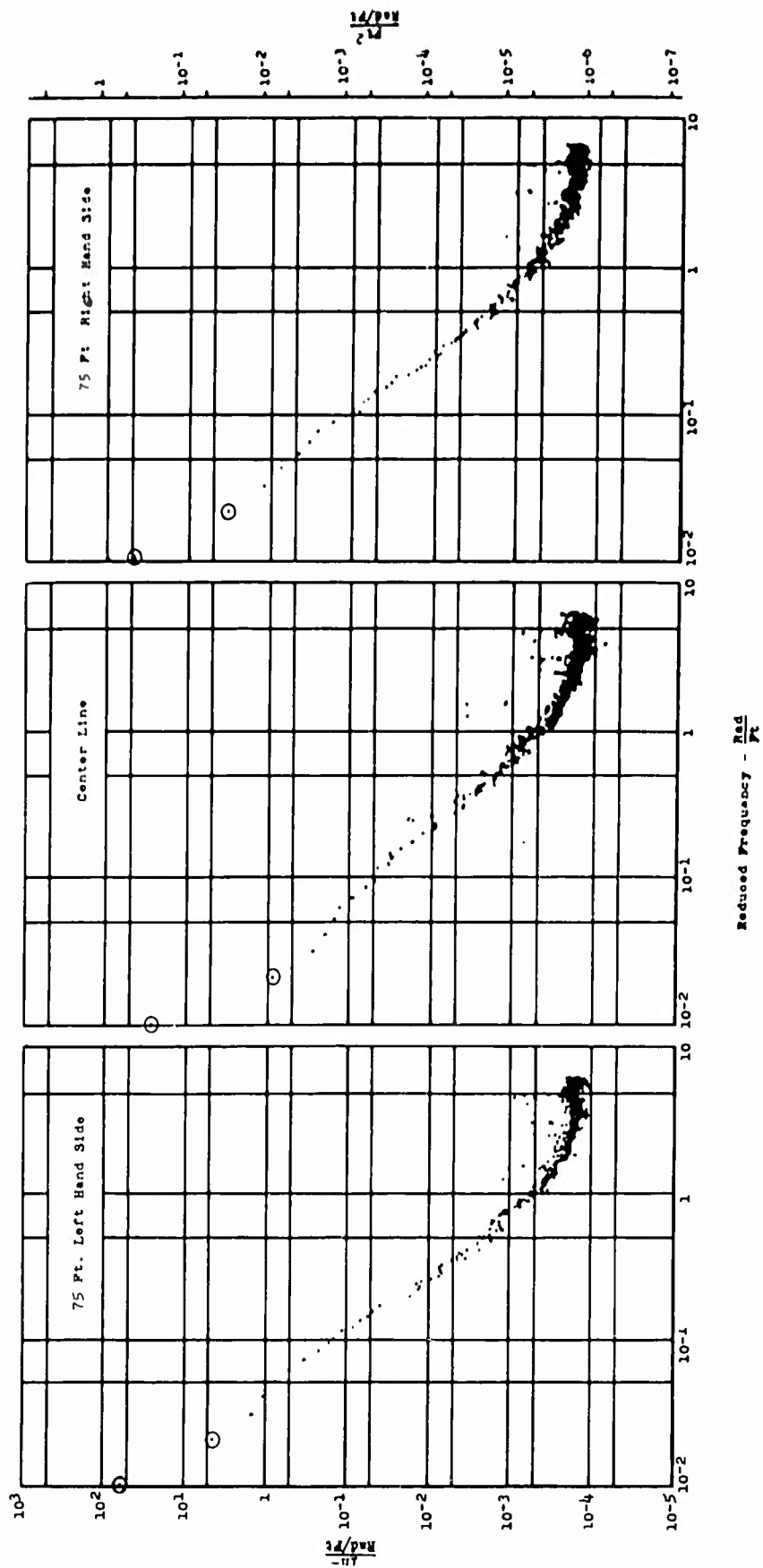


Figure 4 - Power Spectral Density, Runway 35, Altus Air Force Base

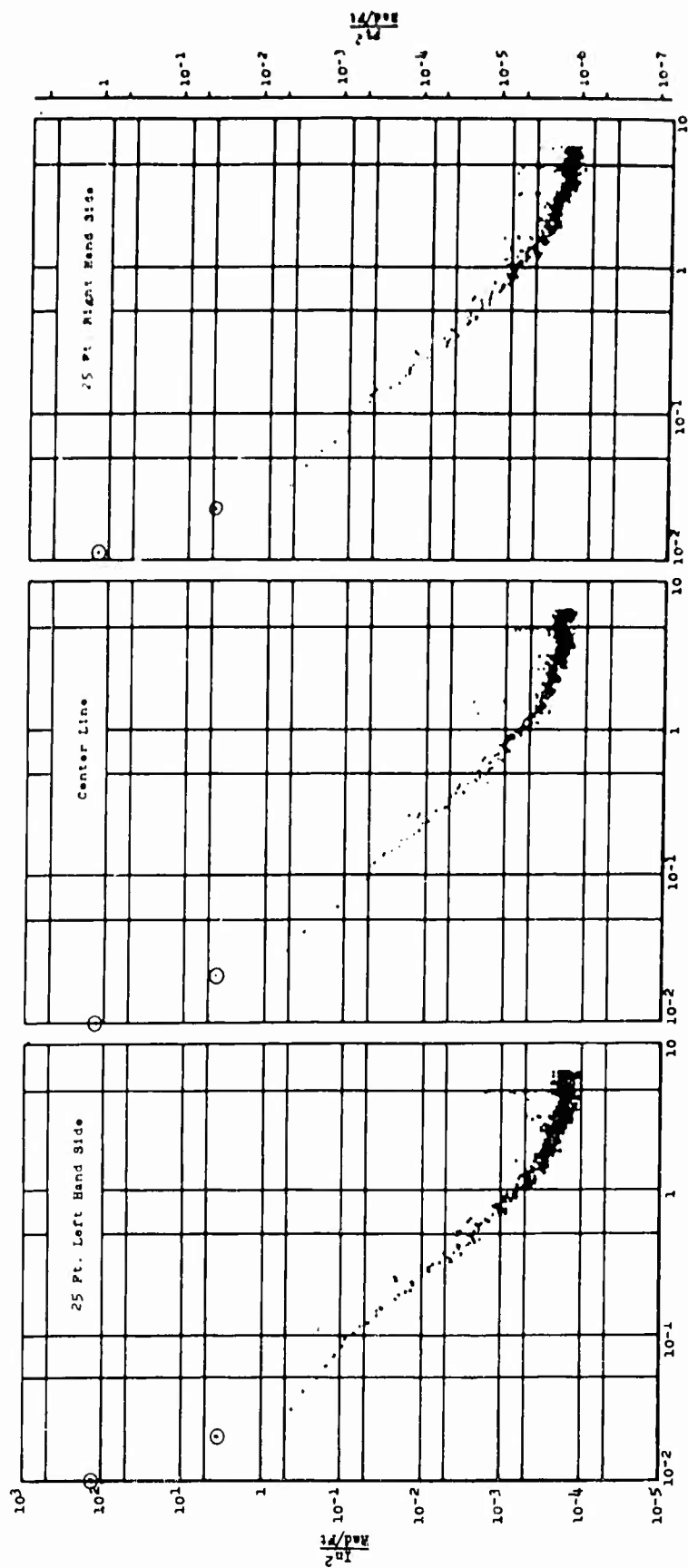


Figure 5 - Power Spectral Density, Taxiway 5, Altus Air Force Base

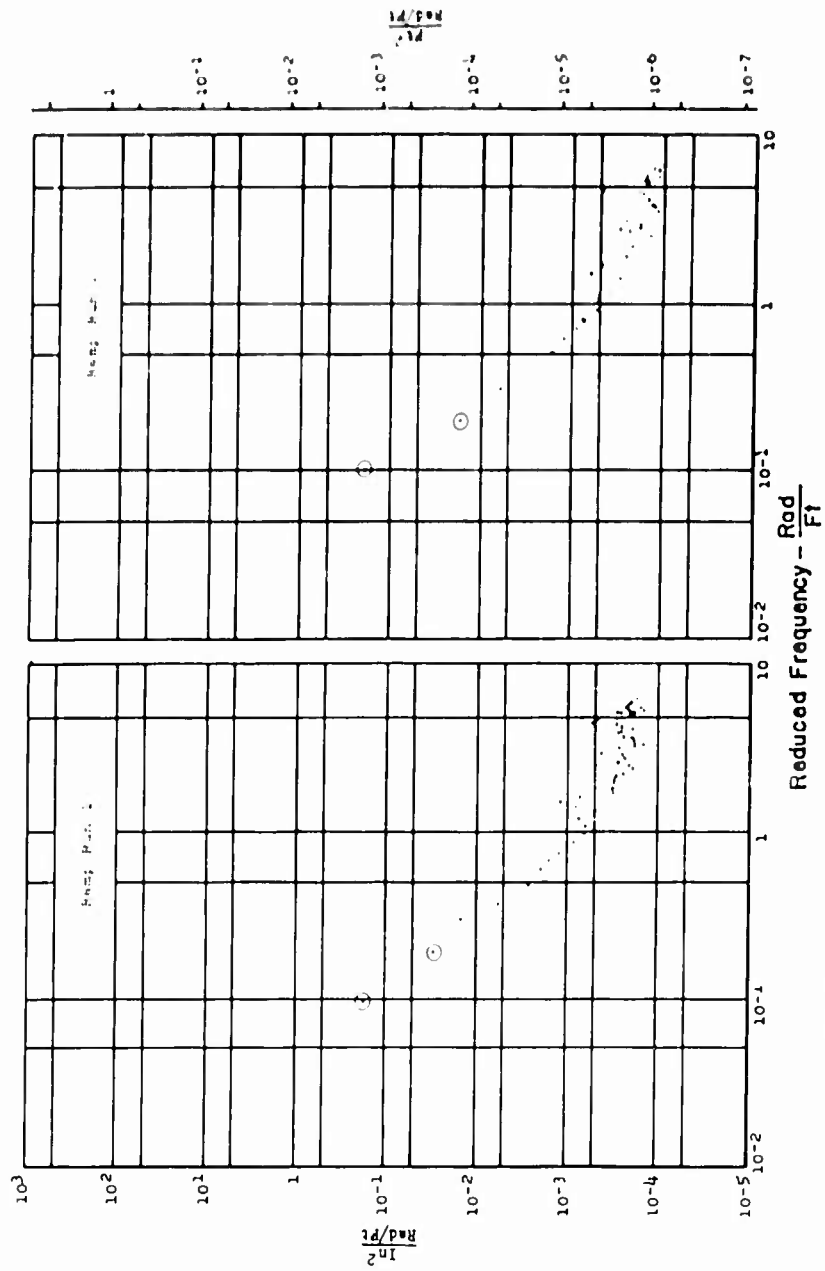
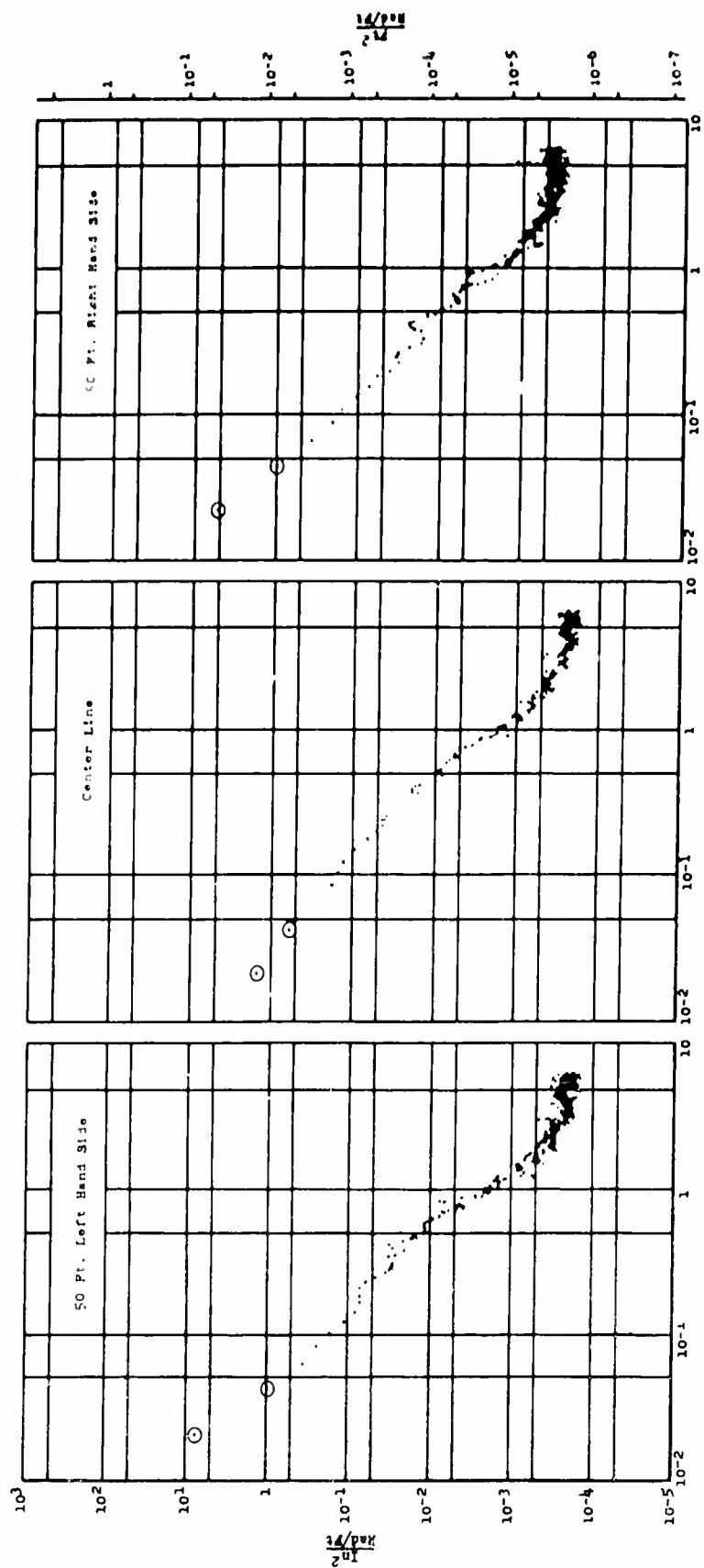
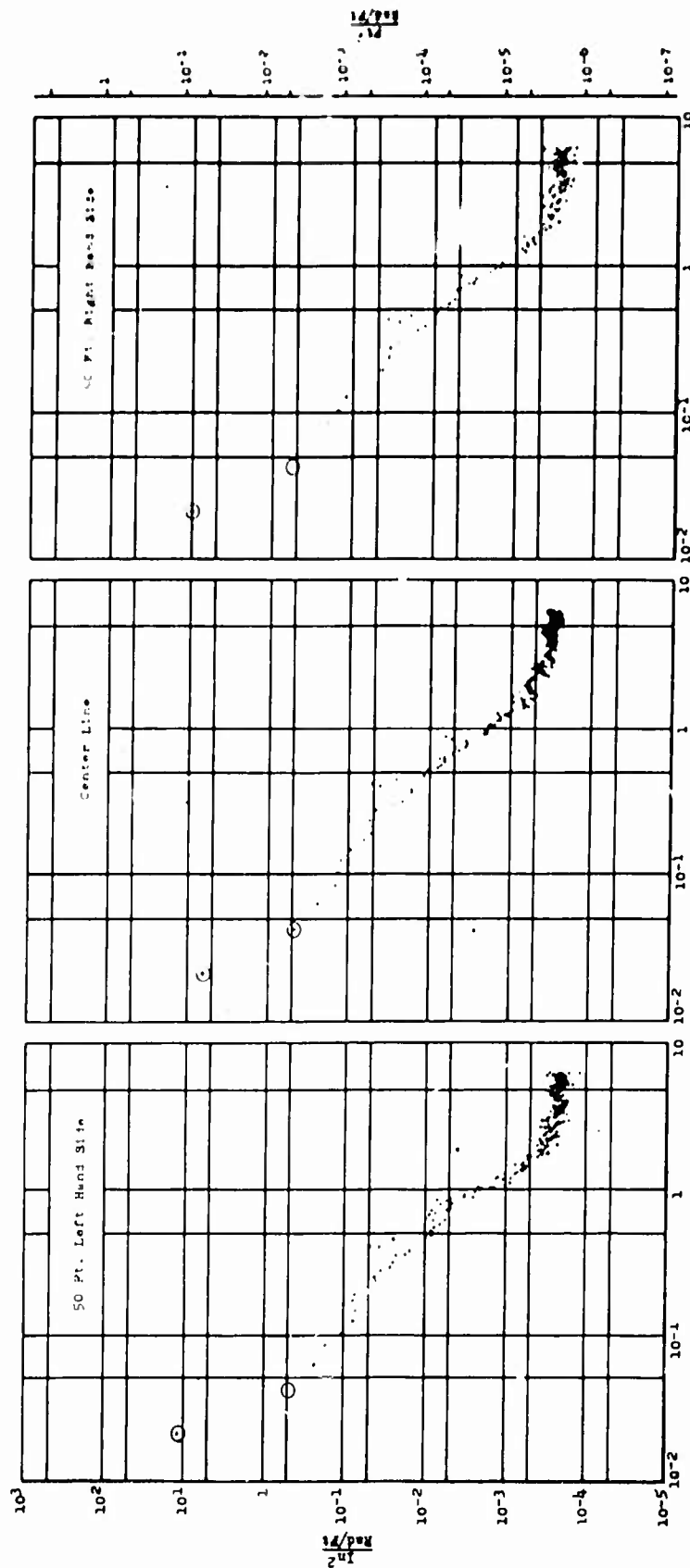


Figure 6 - Power Spectral Density, Altus Air Force Base



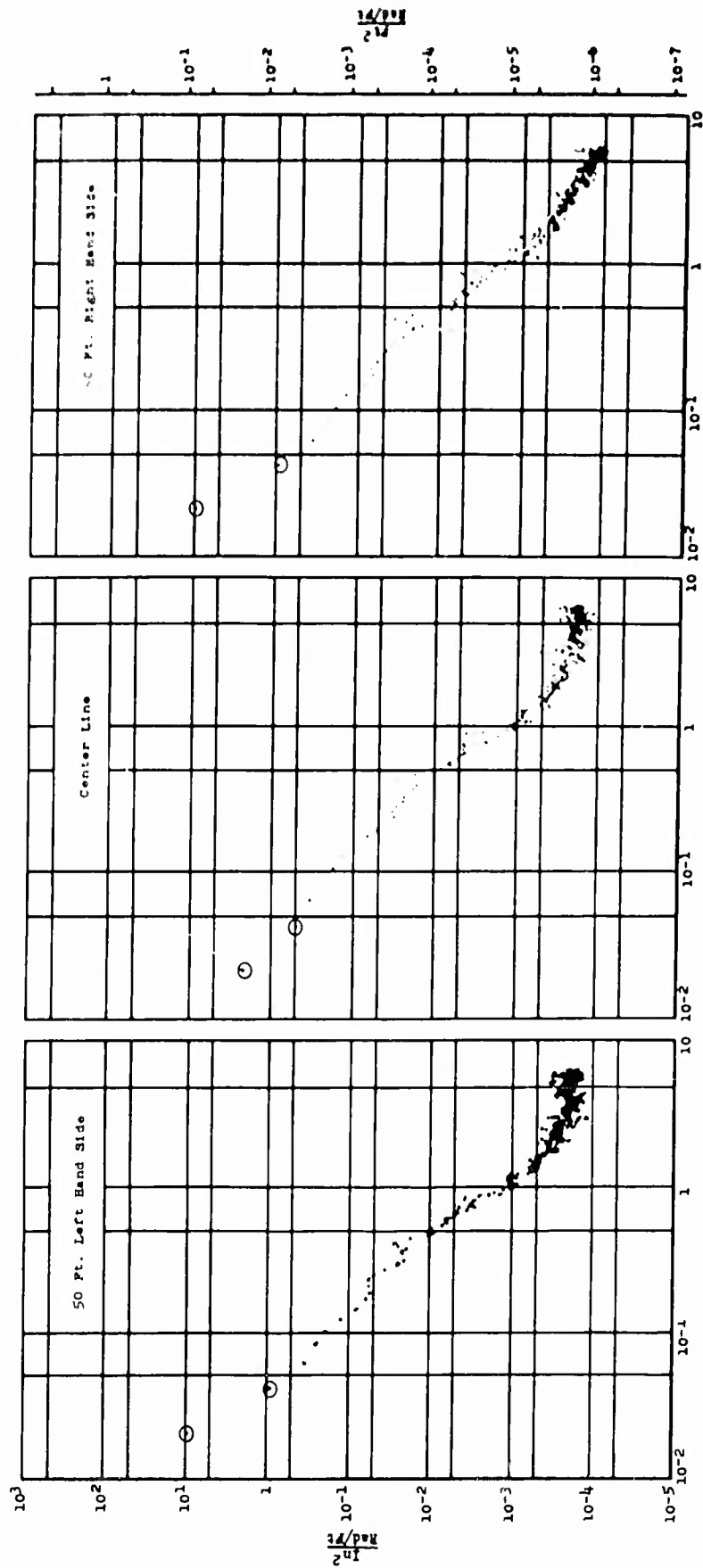
Reduced Frequency - $\frac{H_{ad}}{P_1}$

Figure 7 - Power Spectral Density, Runway 13, Bakalar Air Force Base



Reduced Frequency - $\frac{f}{P_t}$

Figure 8 - Power Spectral Density, Runway 18, Bakalar Air Force Base



Reduced Frequency - $\frac{\text{Rad}}{\text{Pt}}$

Figure 9 - Power Spectral Density, Runway 22, Babalar Air Force Base

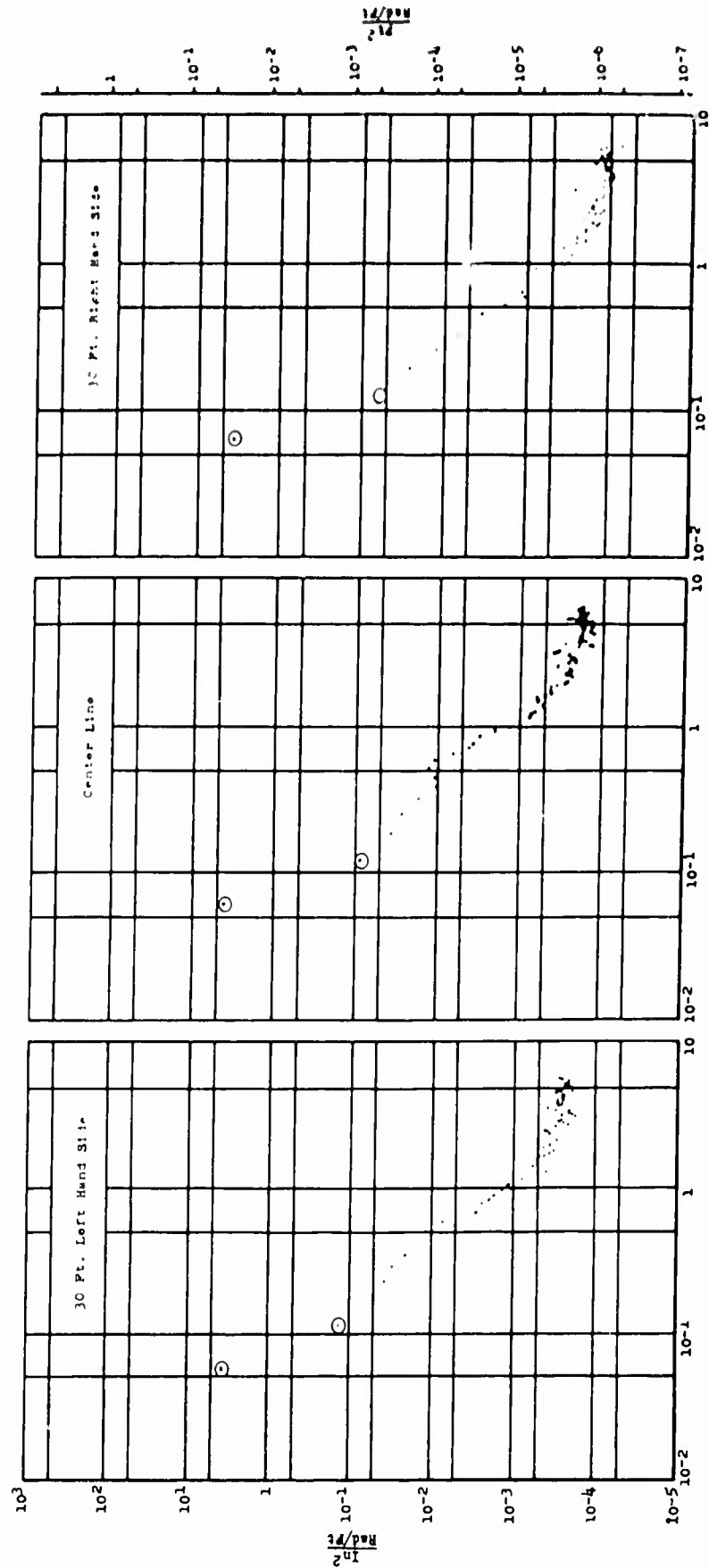


Figure 10 - Power Spectral Density, Taxiway 3, Bakalar Air Force Base

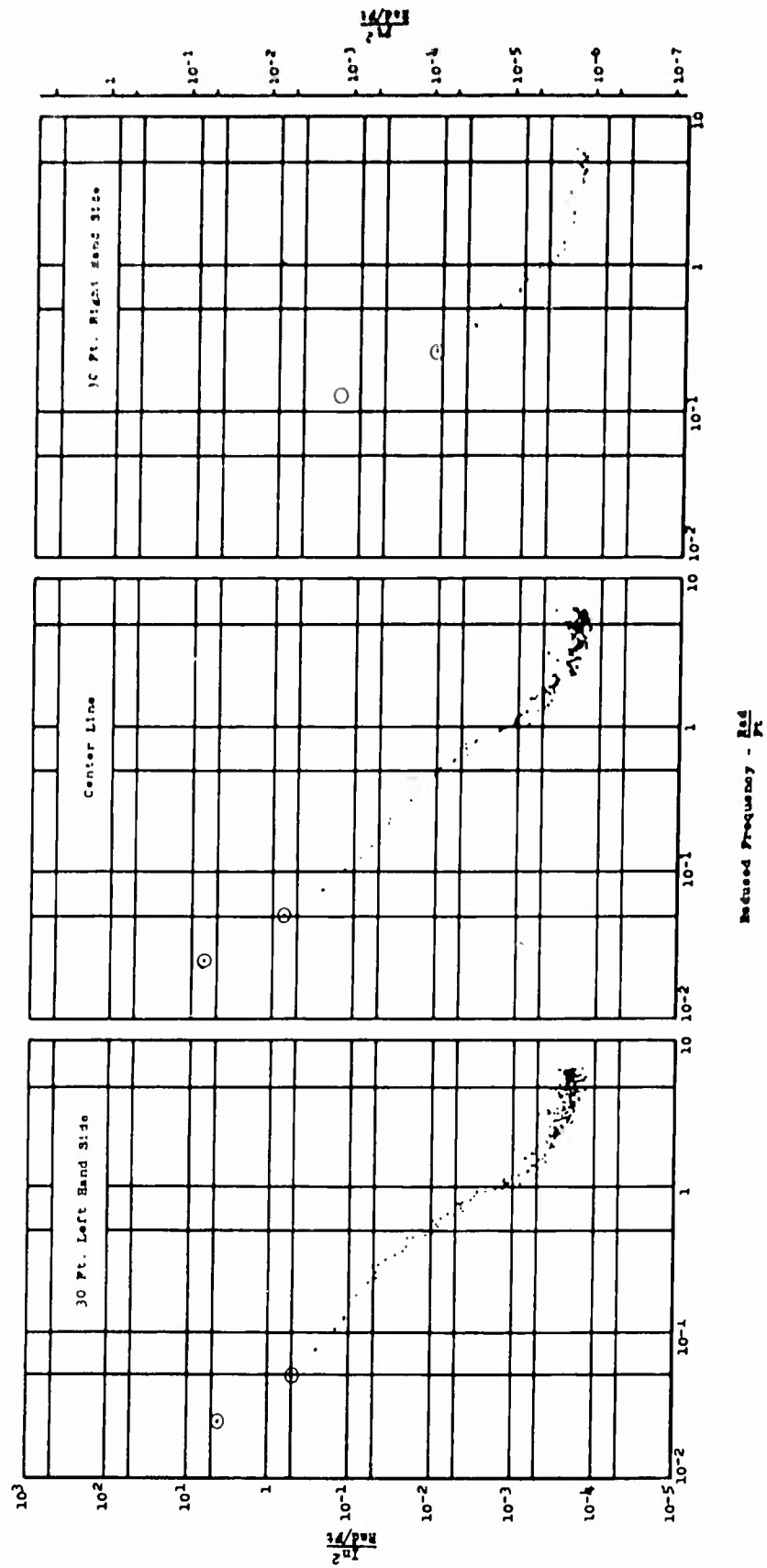


Figure 11 - Power Spectral Density, Taxiway 27, Bakalar Air Force Base

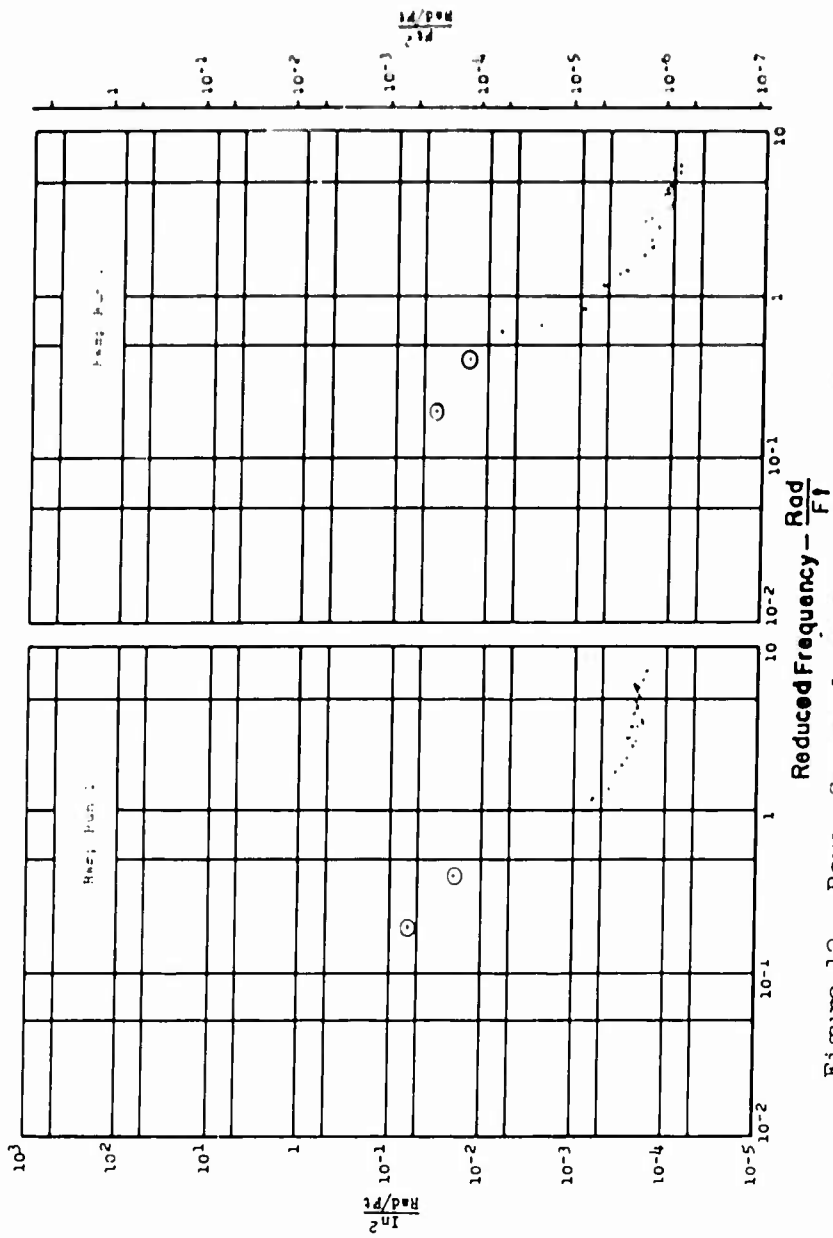


Figure 12 - Power Spectral Density, Bakalar Air Force Base

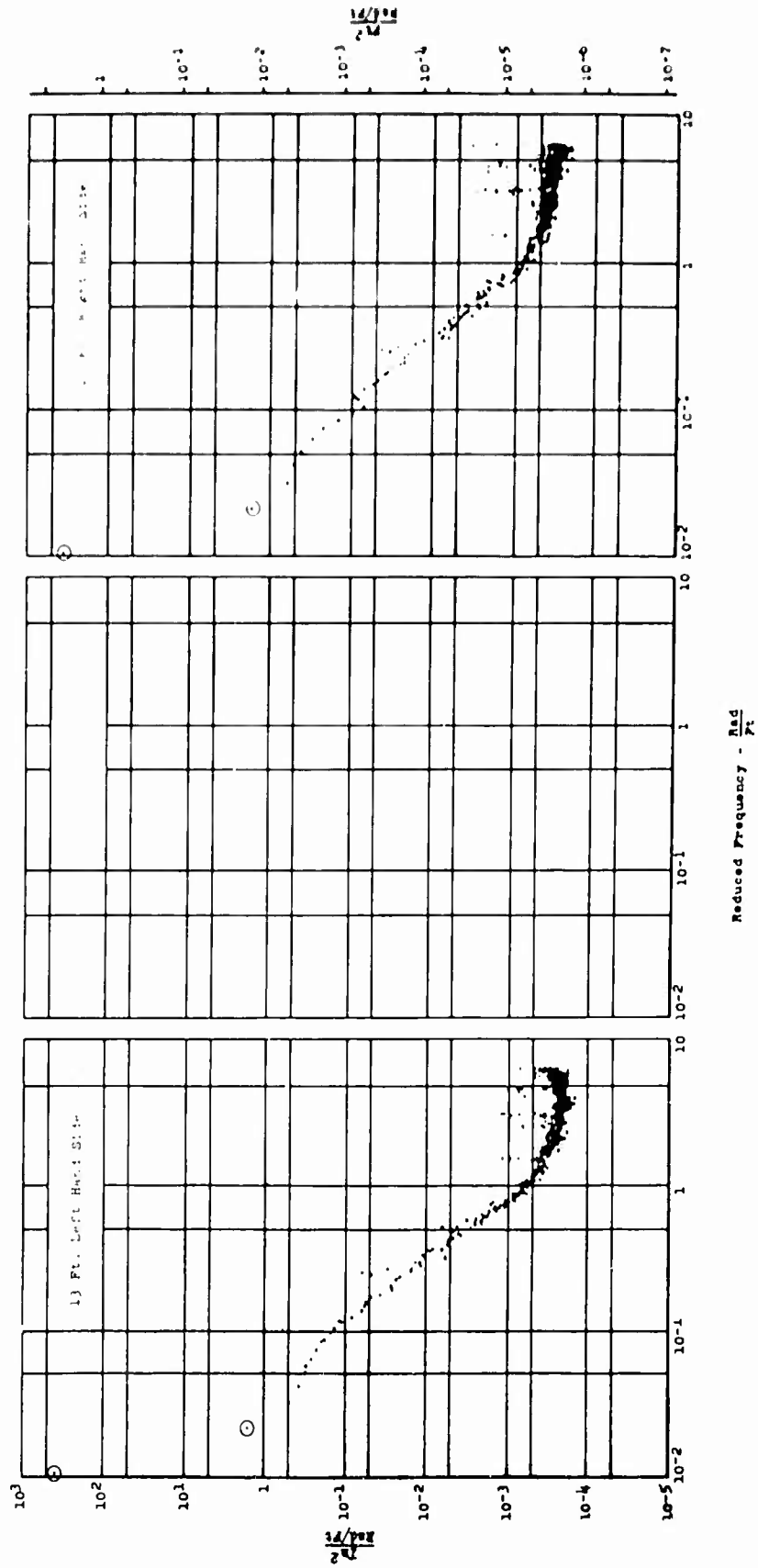


Figure 13 - Power Spectral Density, Runway 17, Carswell Air Force Base

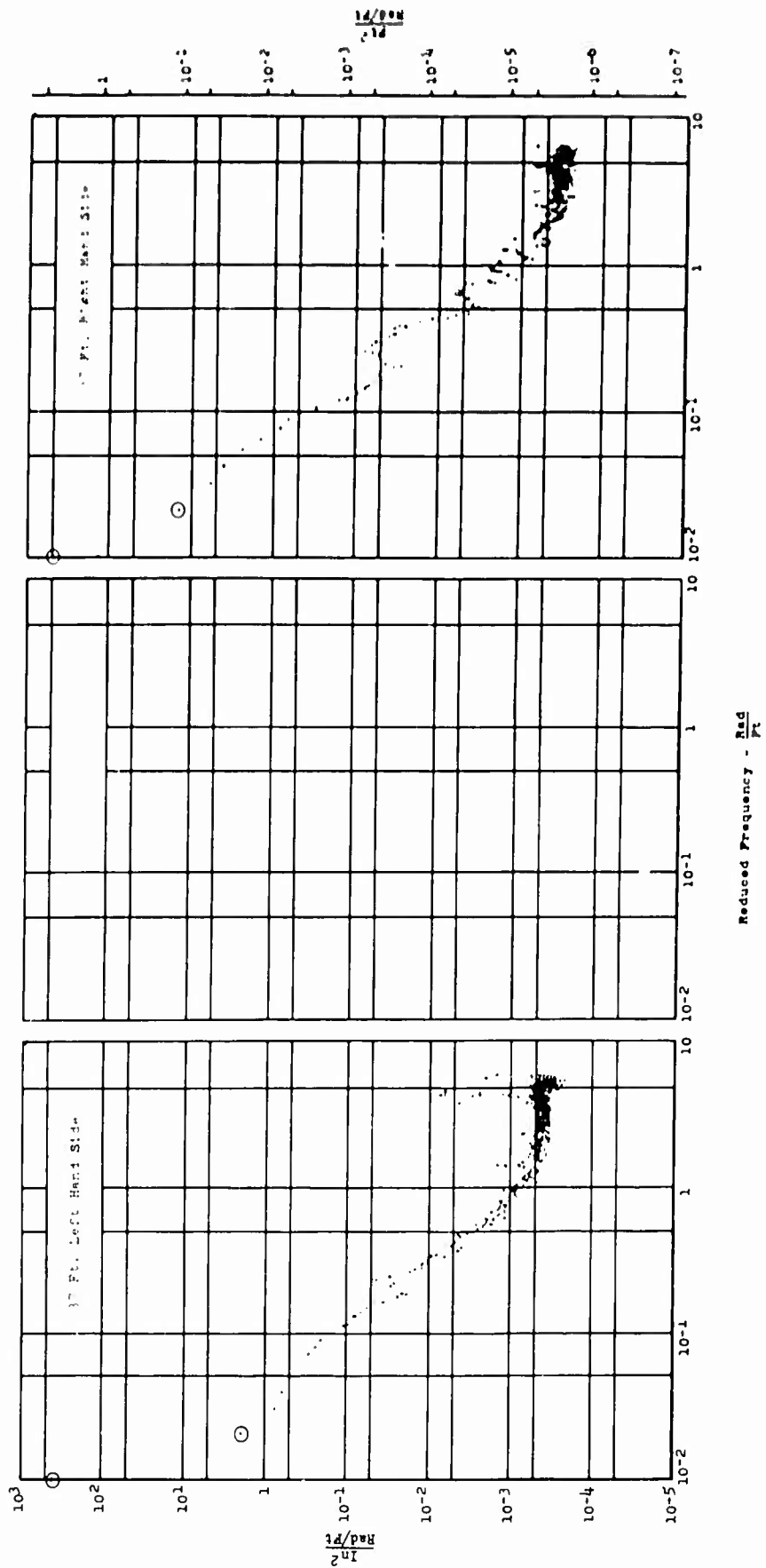


Figure 14 - Power Spectral Density, Runway 17, Carswell Air Force Base

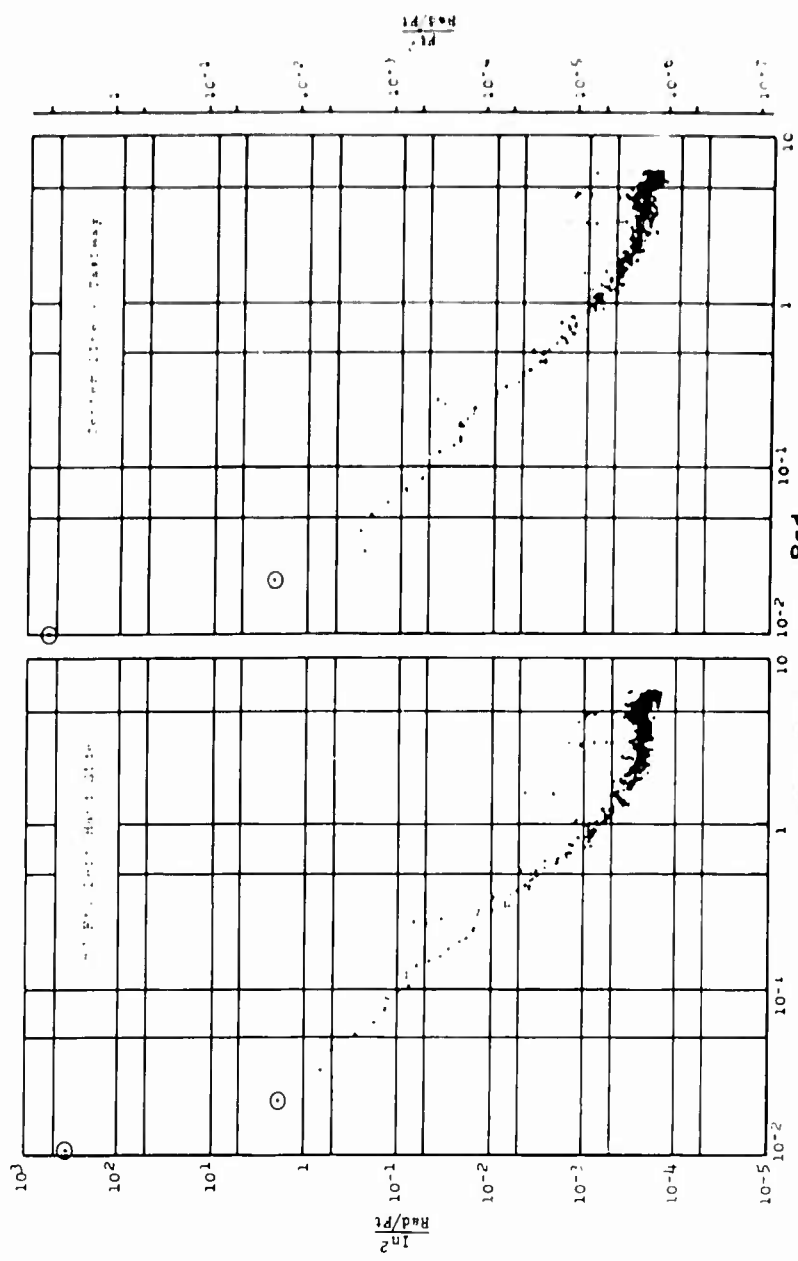


Figure 15 - Power Spectral Density
Side Run Runway 17 - Centerline Taxiway
Carswell Air Force Base

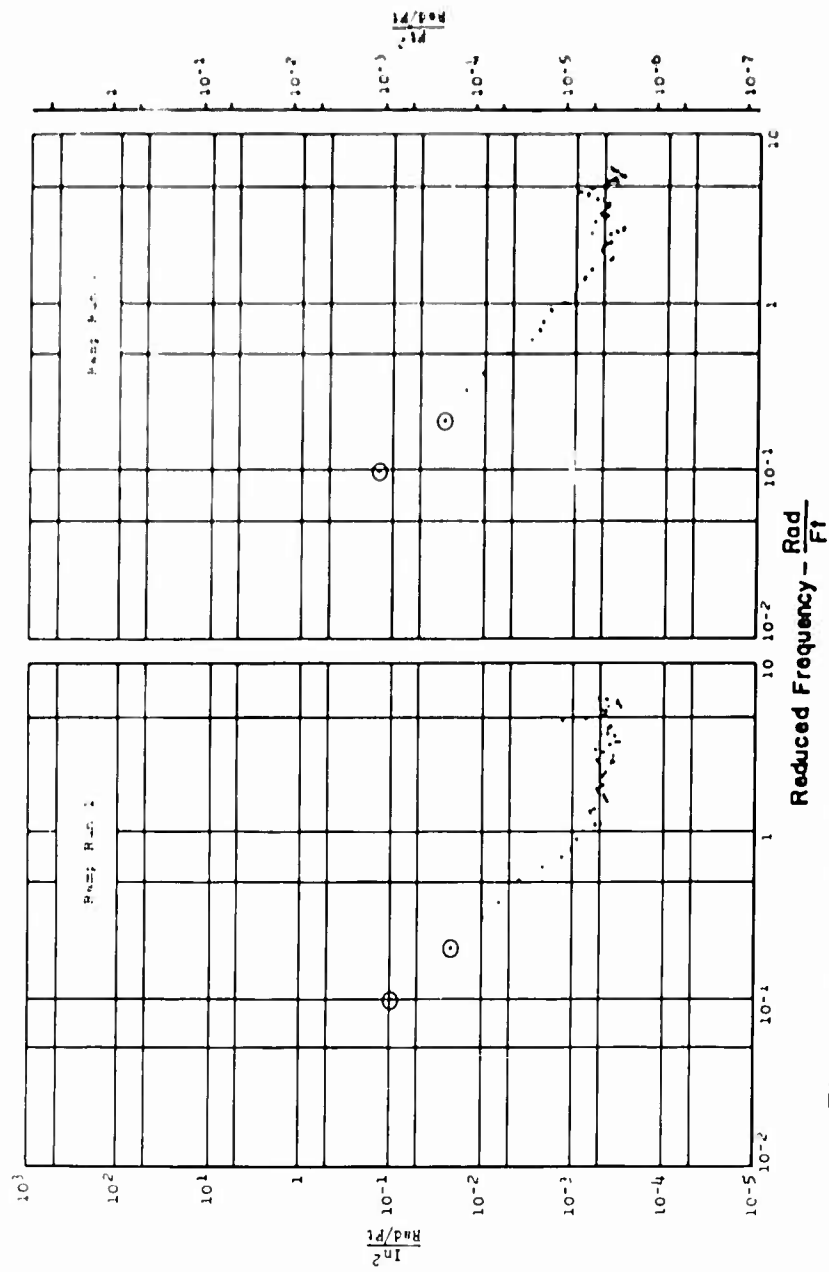
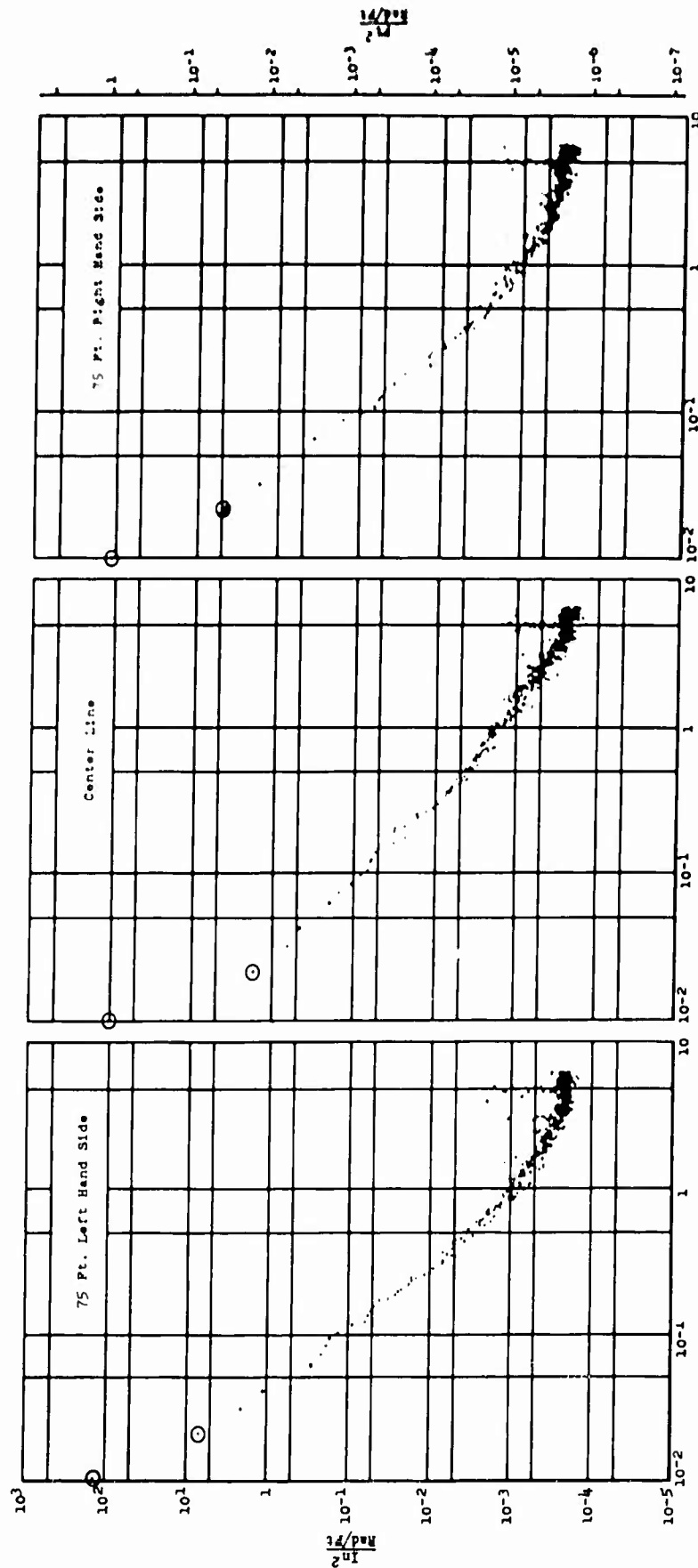


Figure 16 - Power Spectral Density, Carswell Air Force Base



Reduced Frequency - $\frac{F}{F_c}$

Figure 17 - Power Spectral Density, Runway 30, Castle Air Force Base

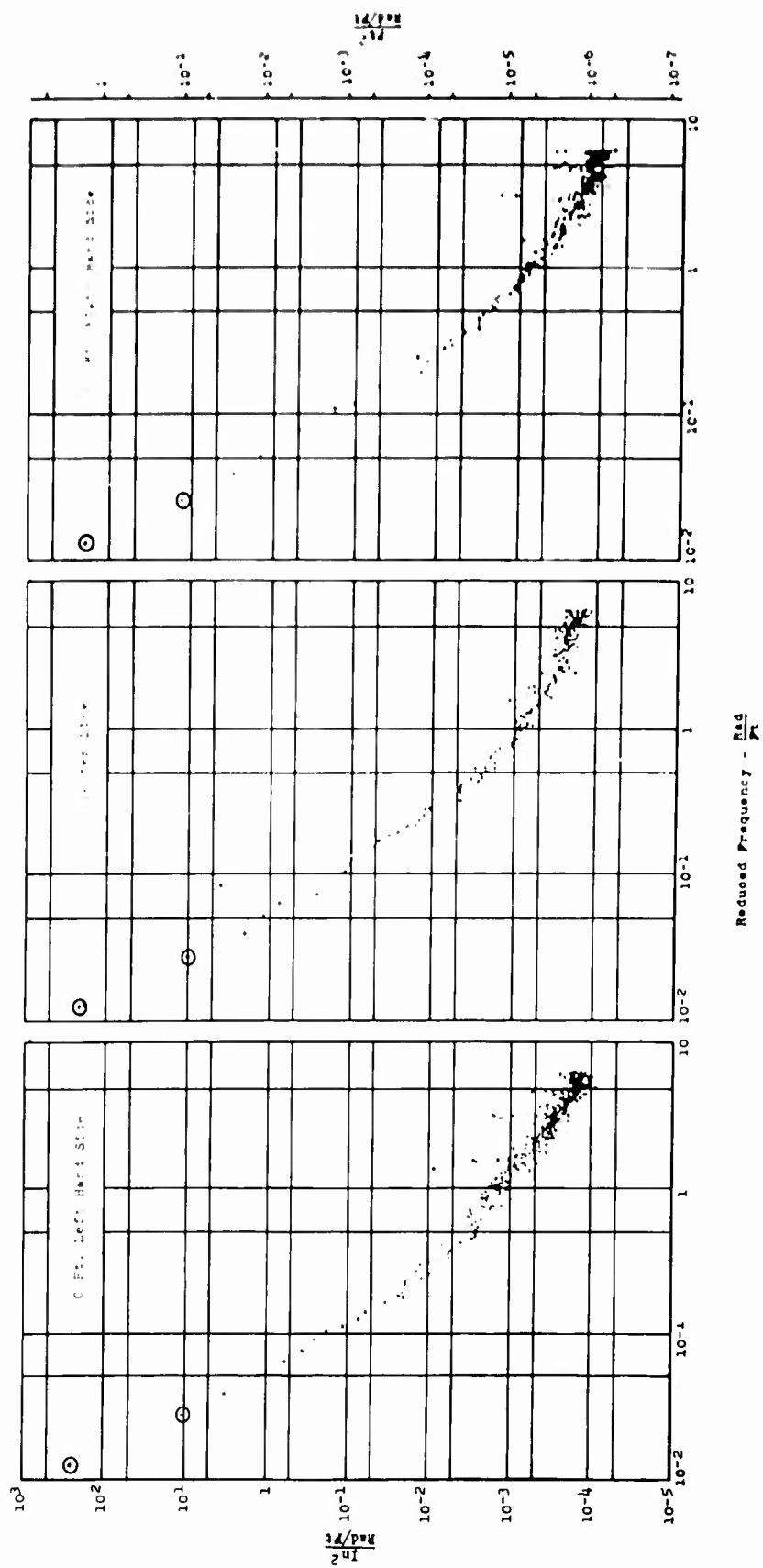


Figure 18 - Power Spectral Density, Taxiway 9, Castle Air Force Base

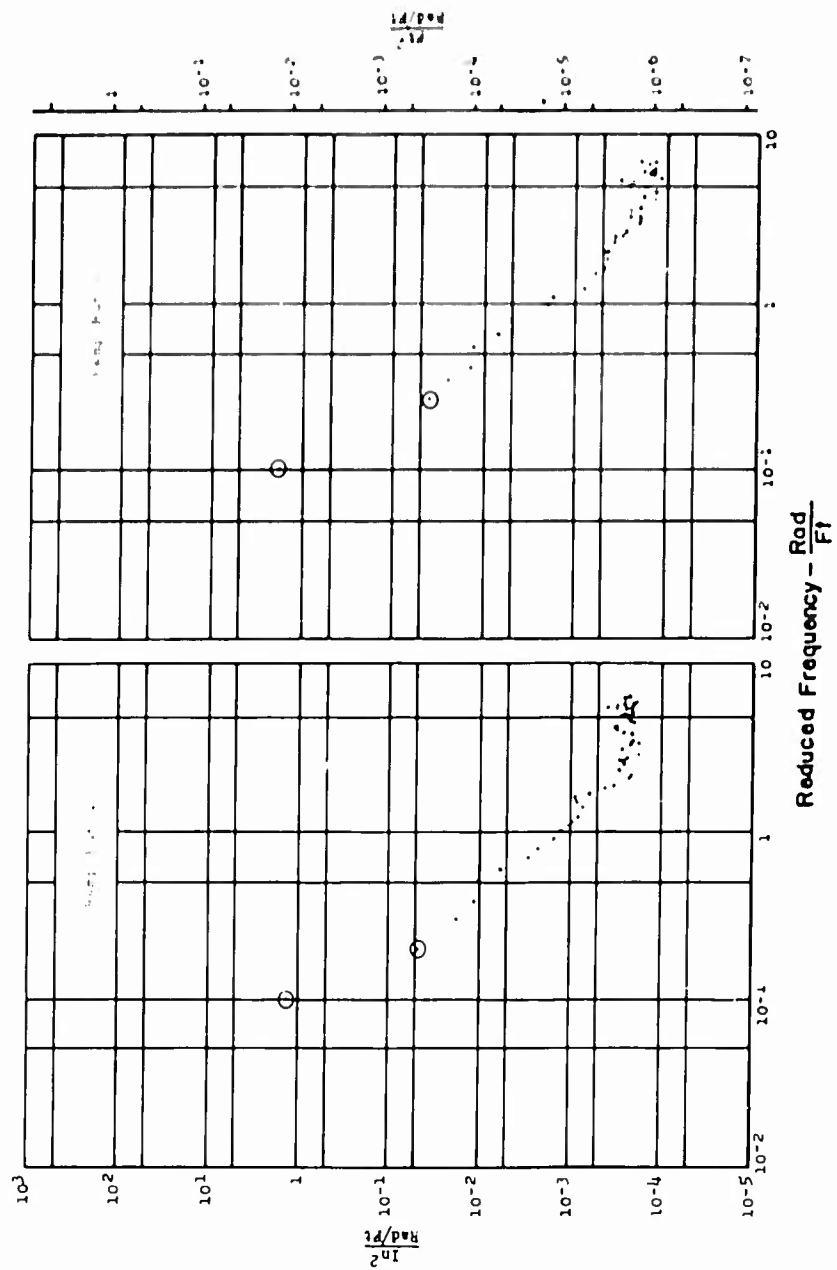


Figure 19 - Power Spectral Density, Castle Air Force Base

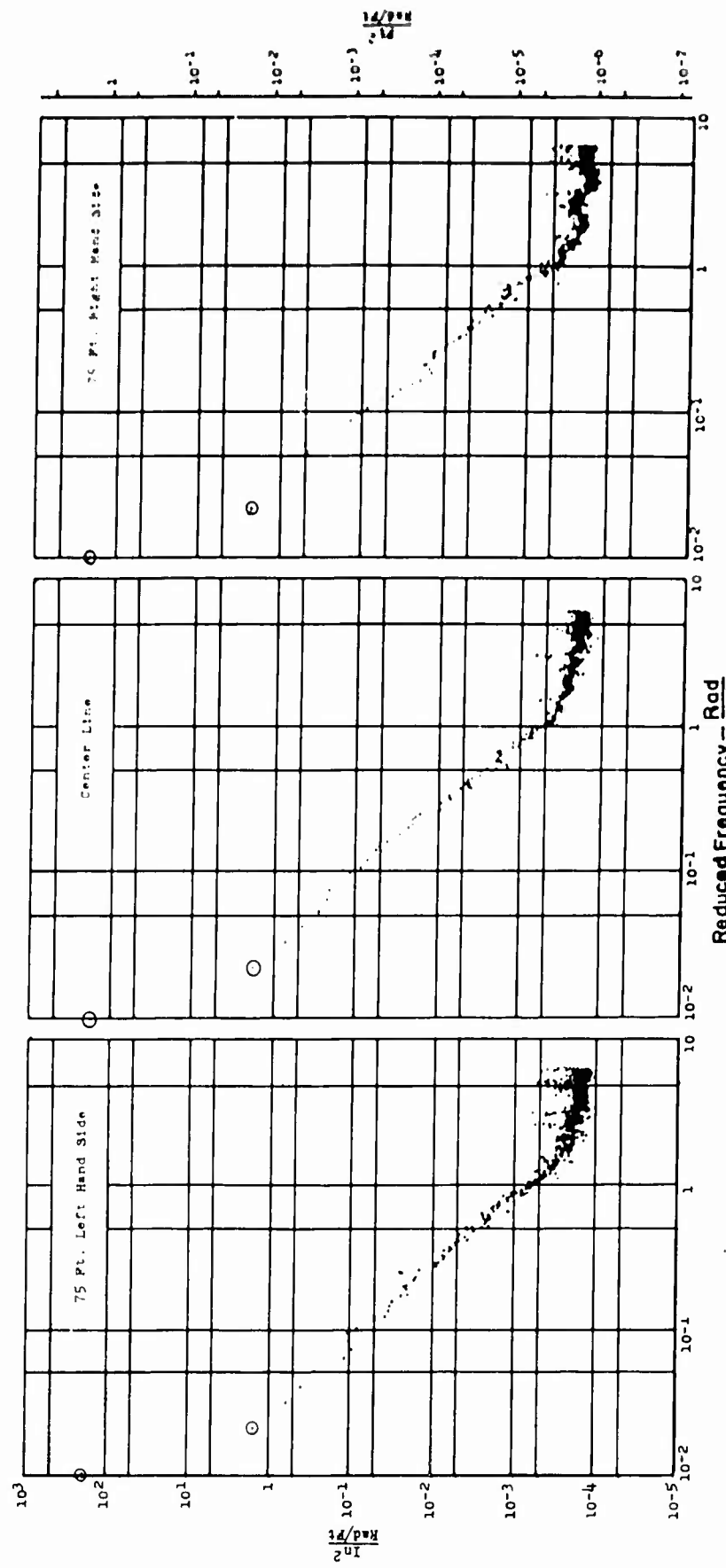


Figure 20 - Power Spectral Density, Runway 10, Dobbins Air Force Base

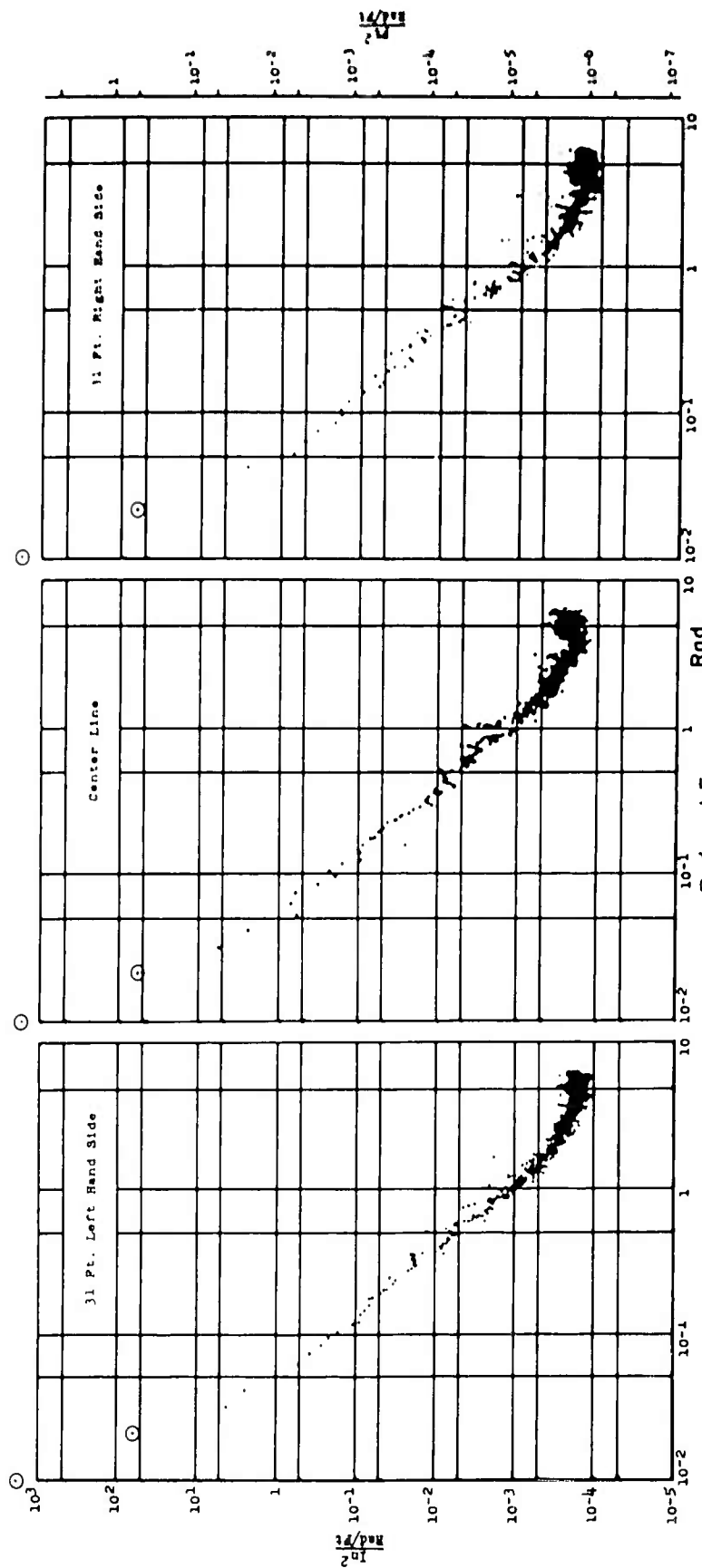


Figure 21 - Power Spectral Density, Taxiway 10, Dobbins Air Force Base

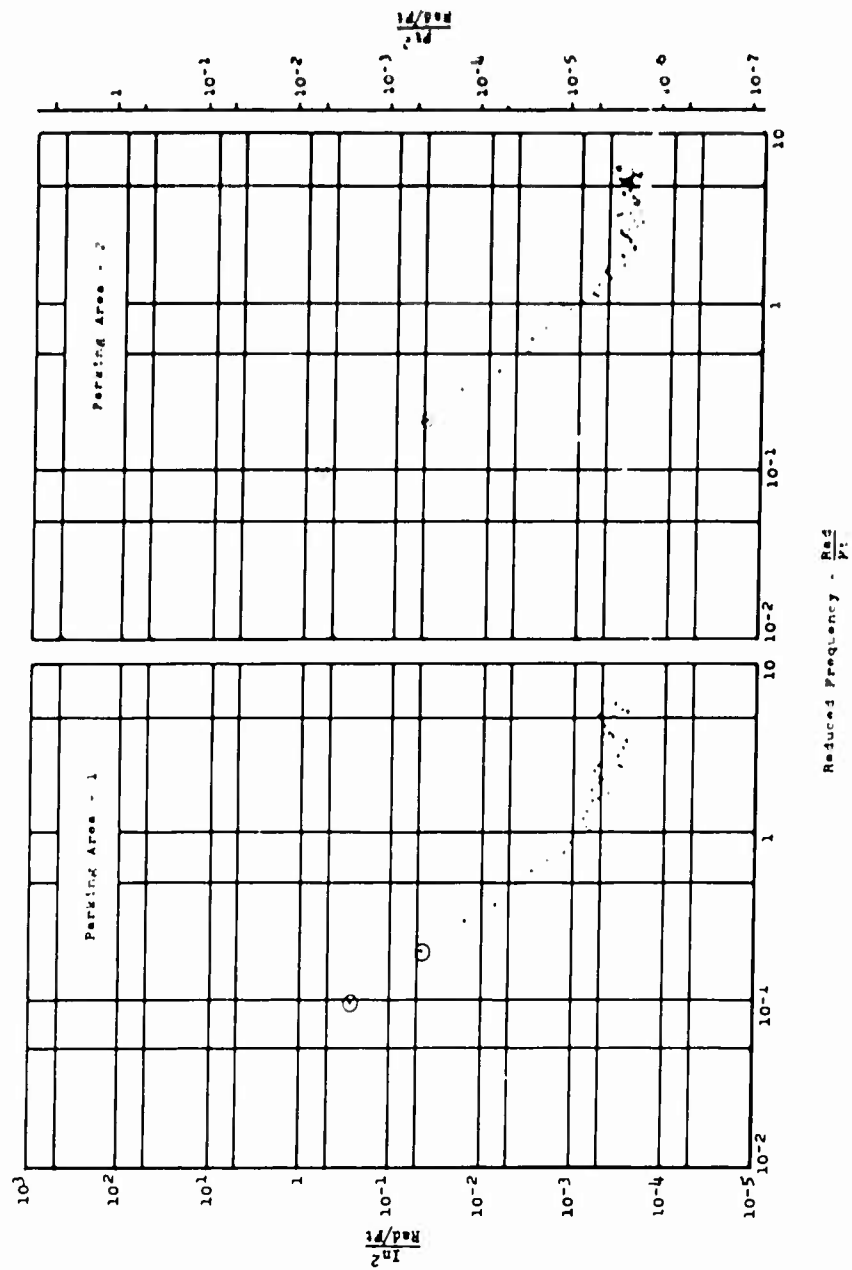


Figure 22 - Power Spectral Density, Dobbins Air Force Base

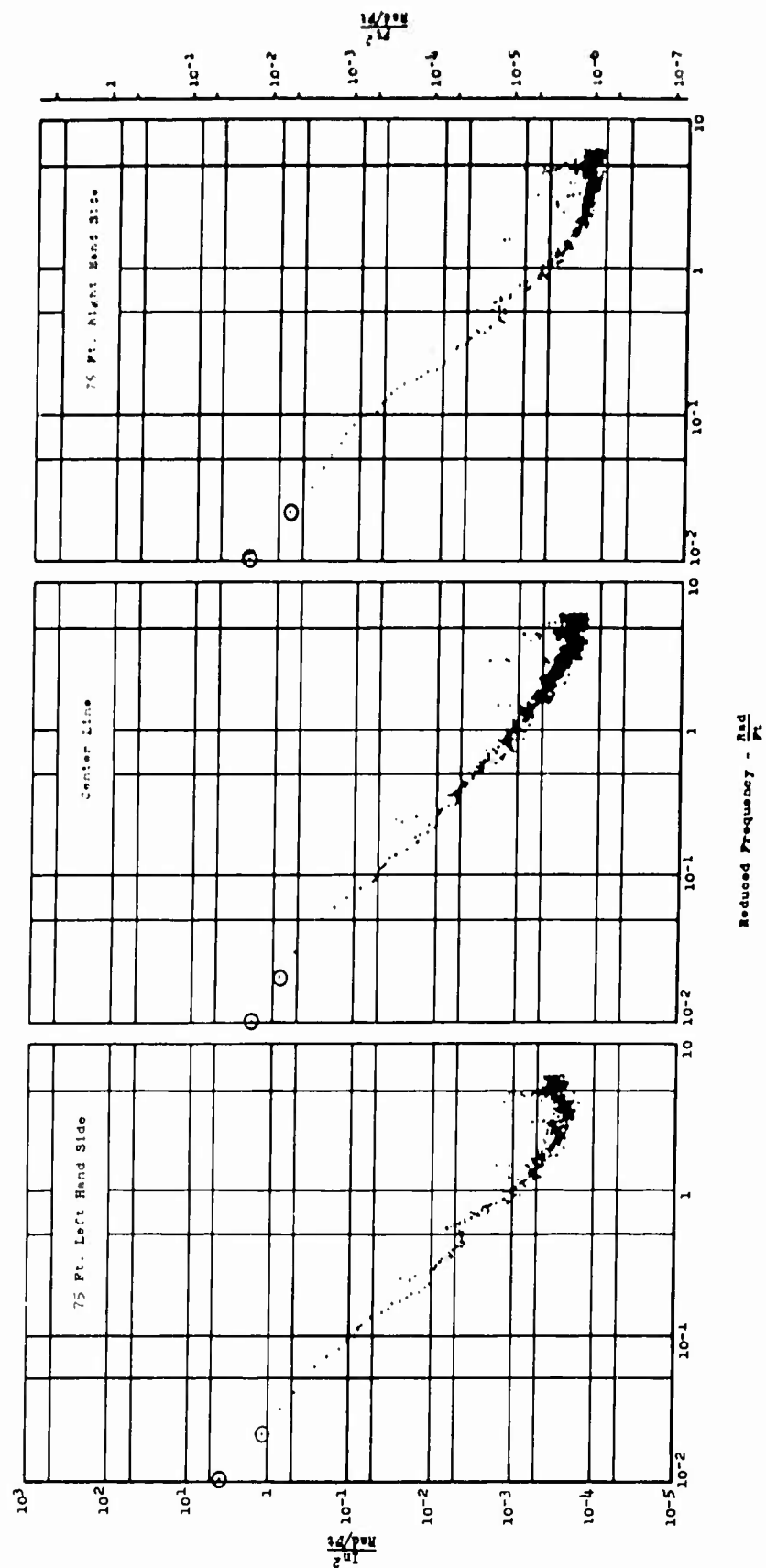


Figure 23 - Power Spectral Density, Runway 4, Edwards Air Force Base

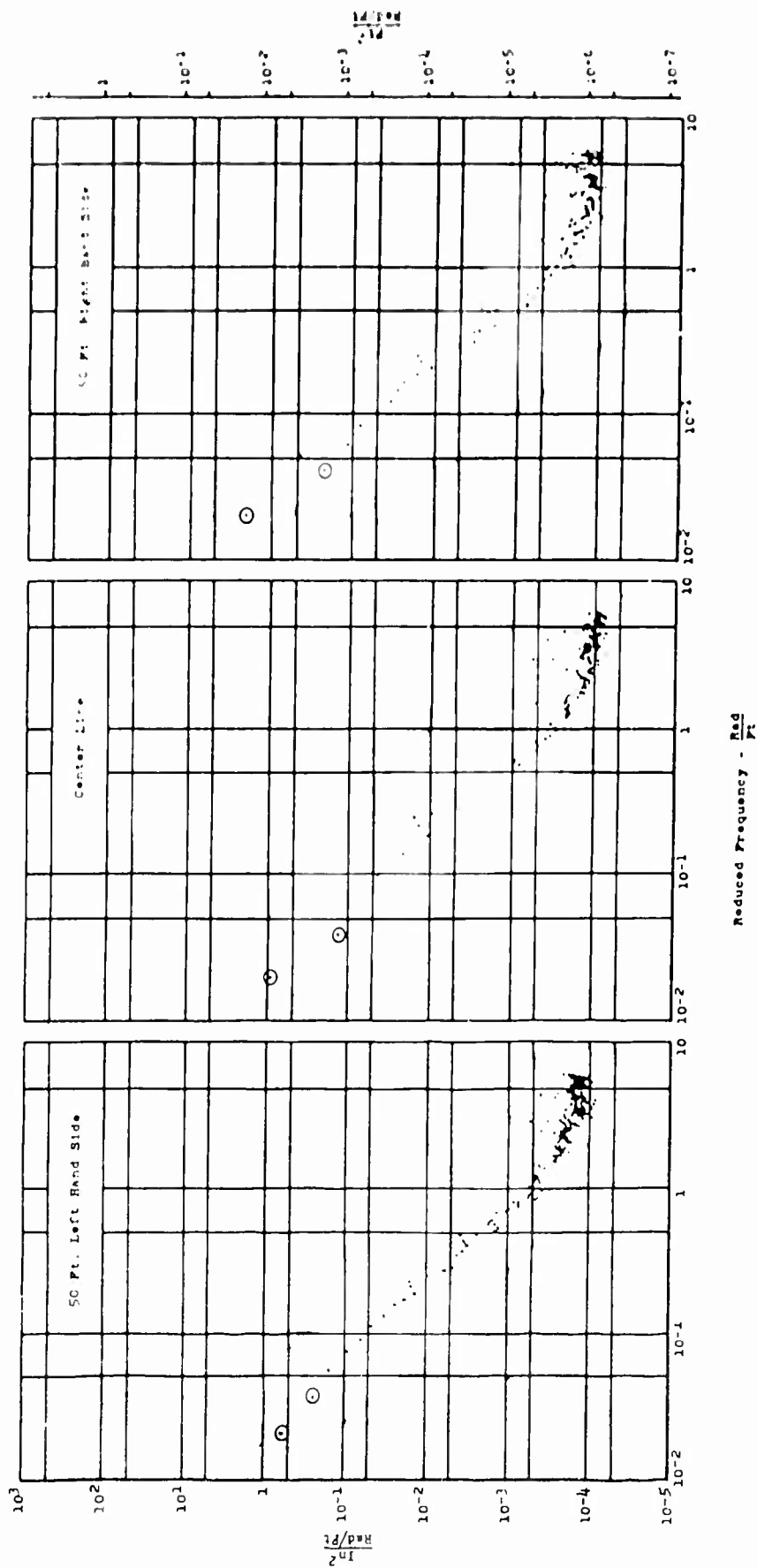


Figure 24 - Power Spectral Density, West Taxiway, Edwards Air Force Base

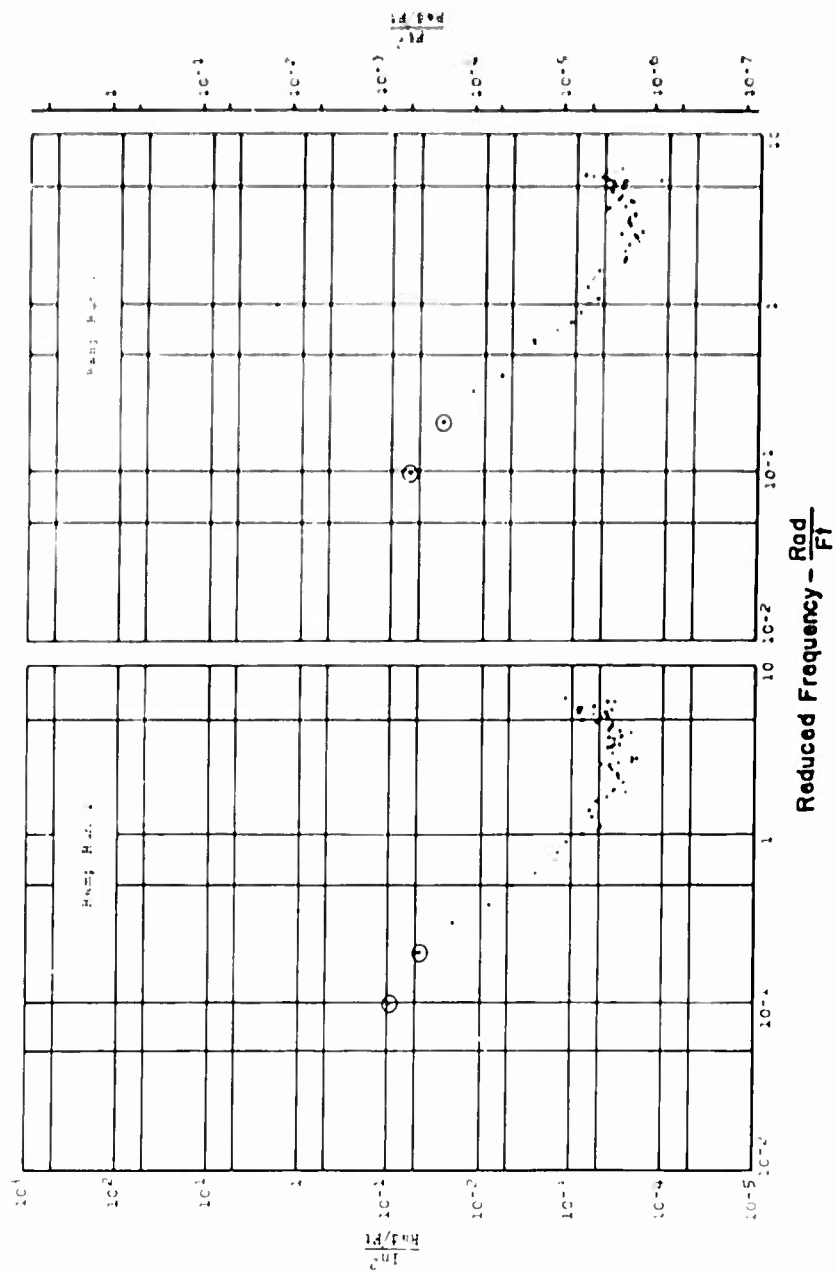


Figure 25 - Power Spectral Density, Edwards Air Force Base

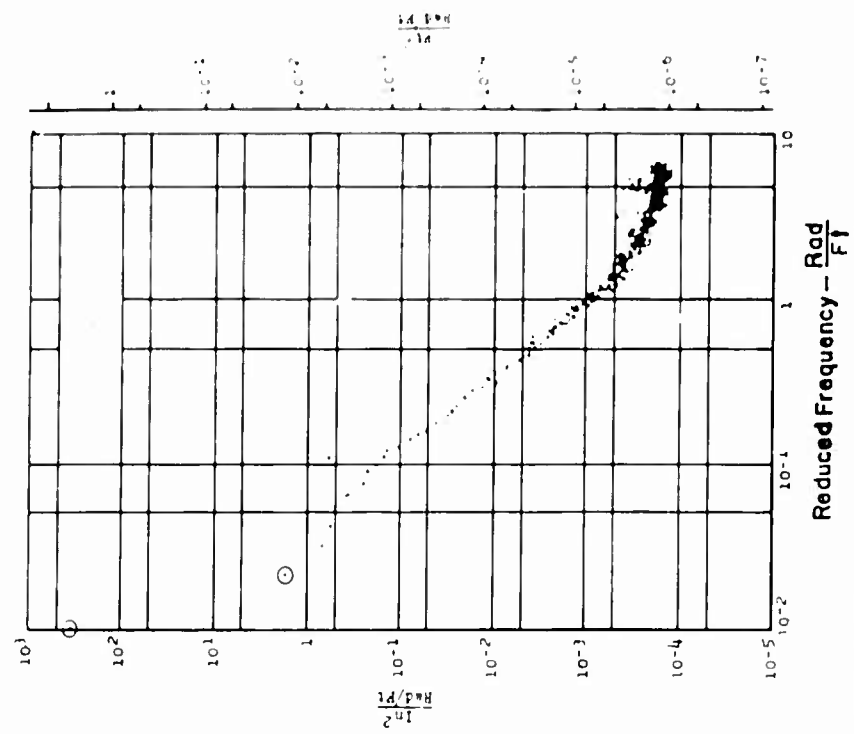


Figure 25 - Power Spectral Density, Runway 30, Ellsworth Air Force Base

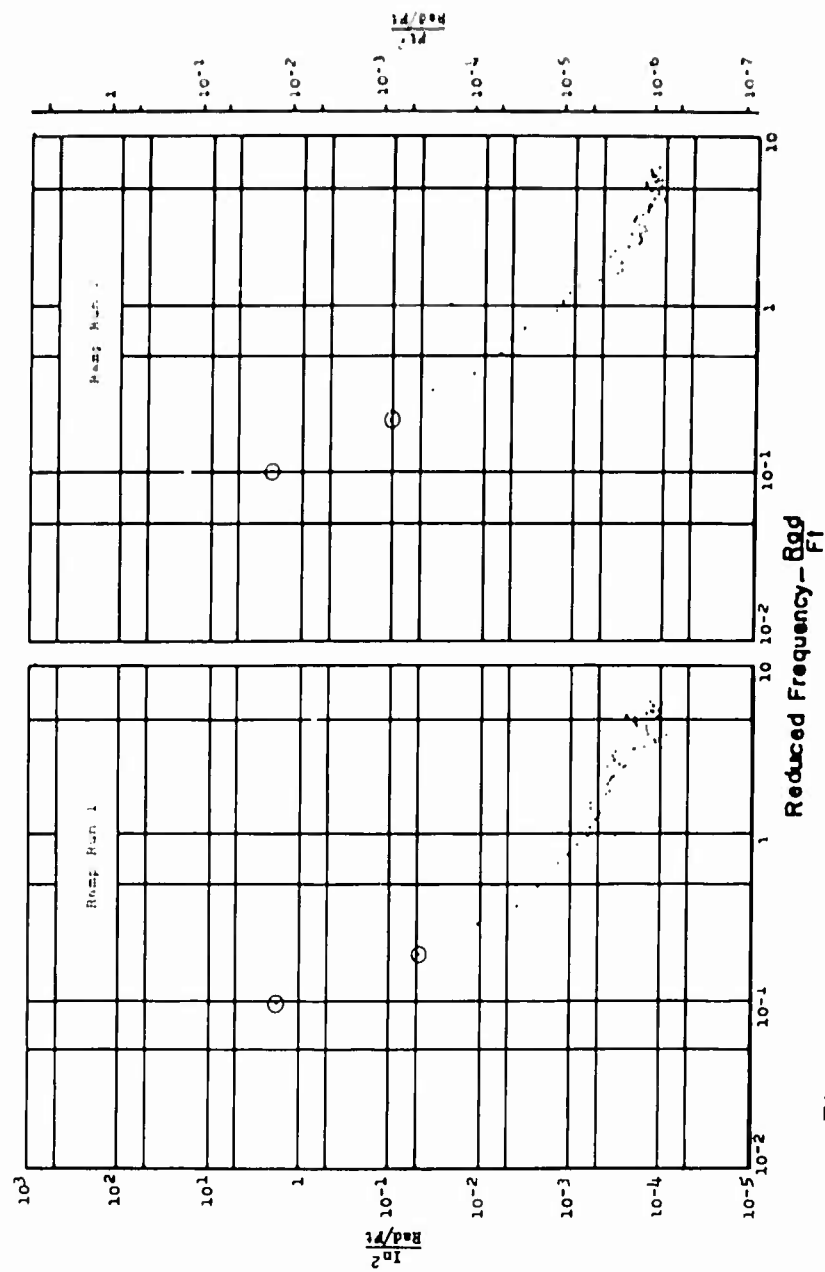


Figure 27 - Power Spectral Density, Ellsworth Air Force Base

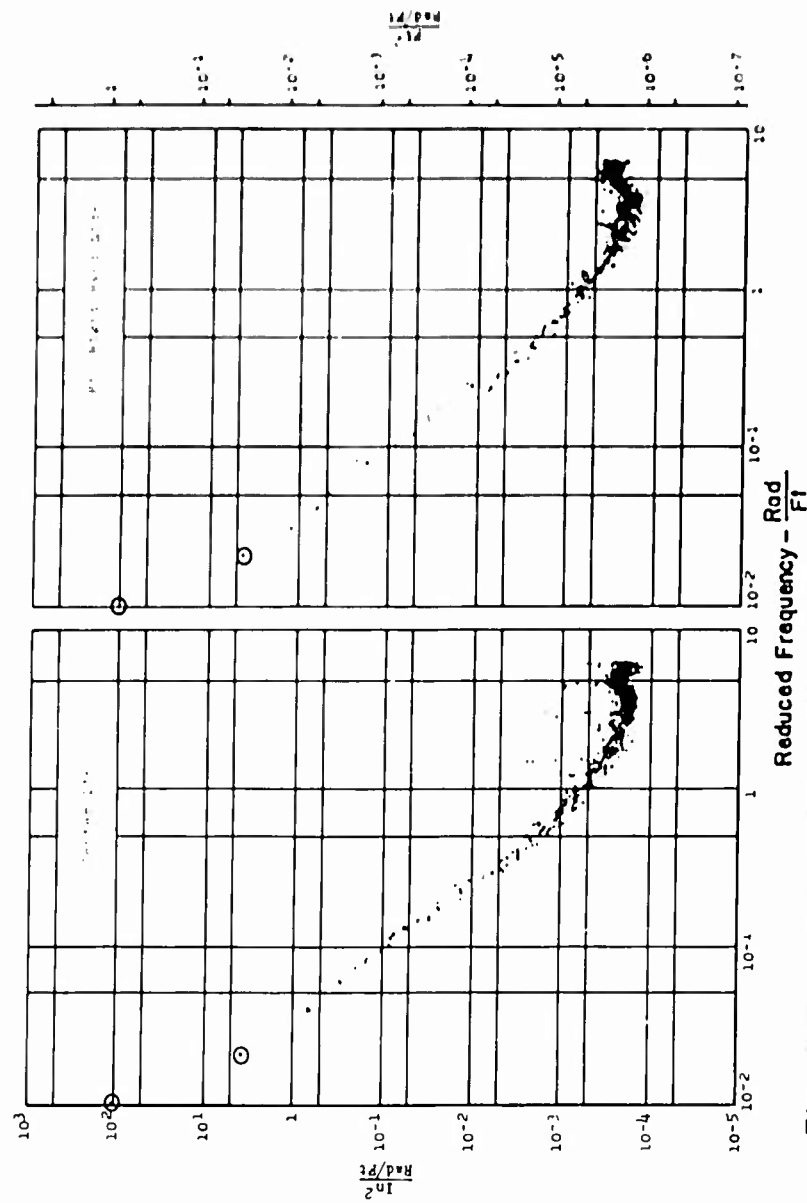


Figure 28 - Power Spectral Density, Runway 16, George Air Force Base

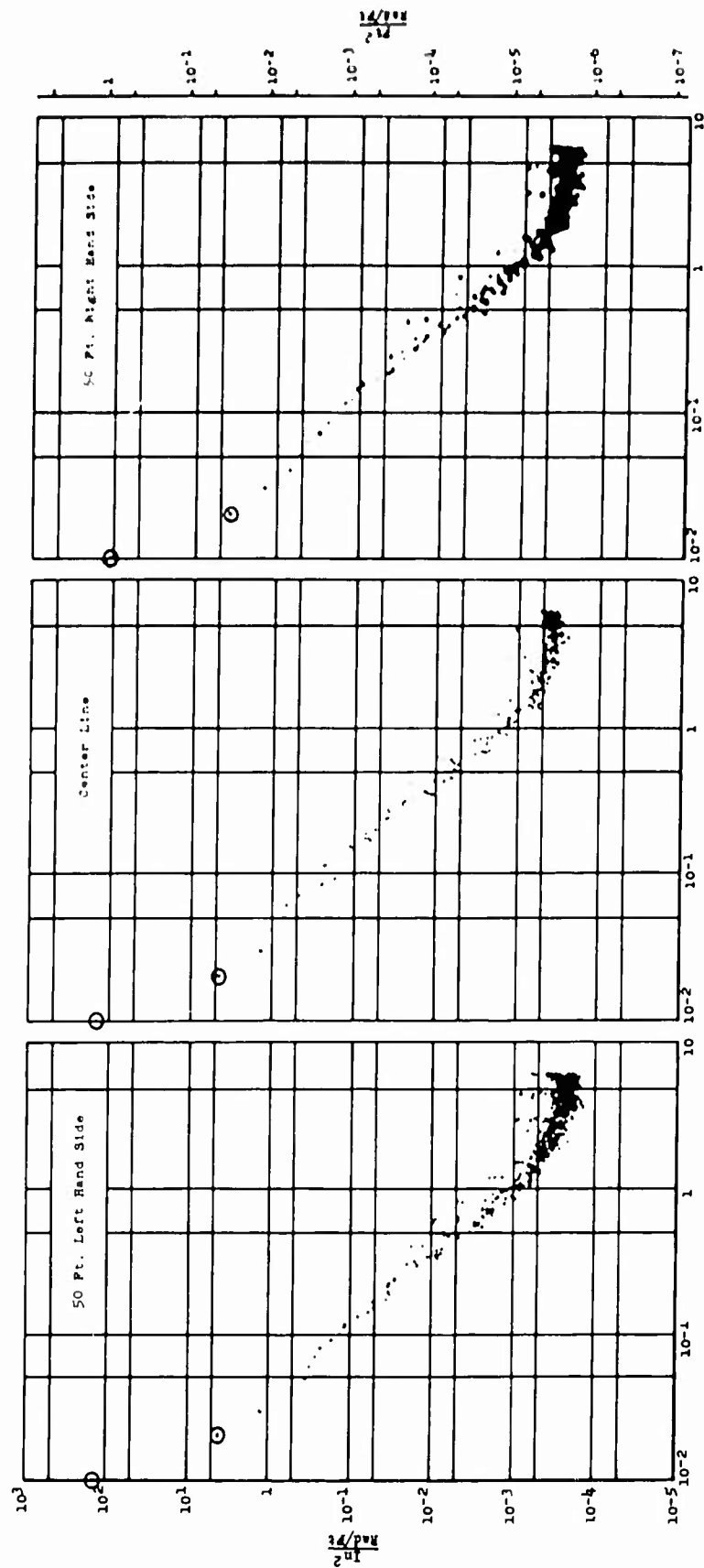


Figure 29 - Power Spectral Density, Runway 3, George Air Force Base

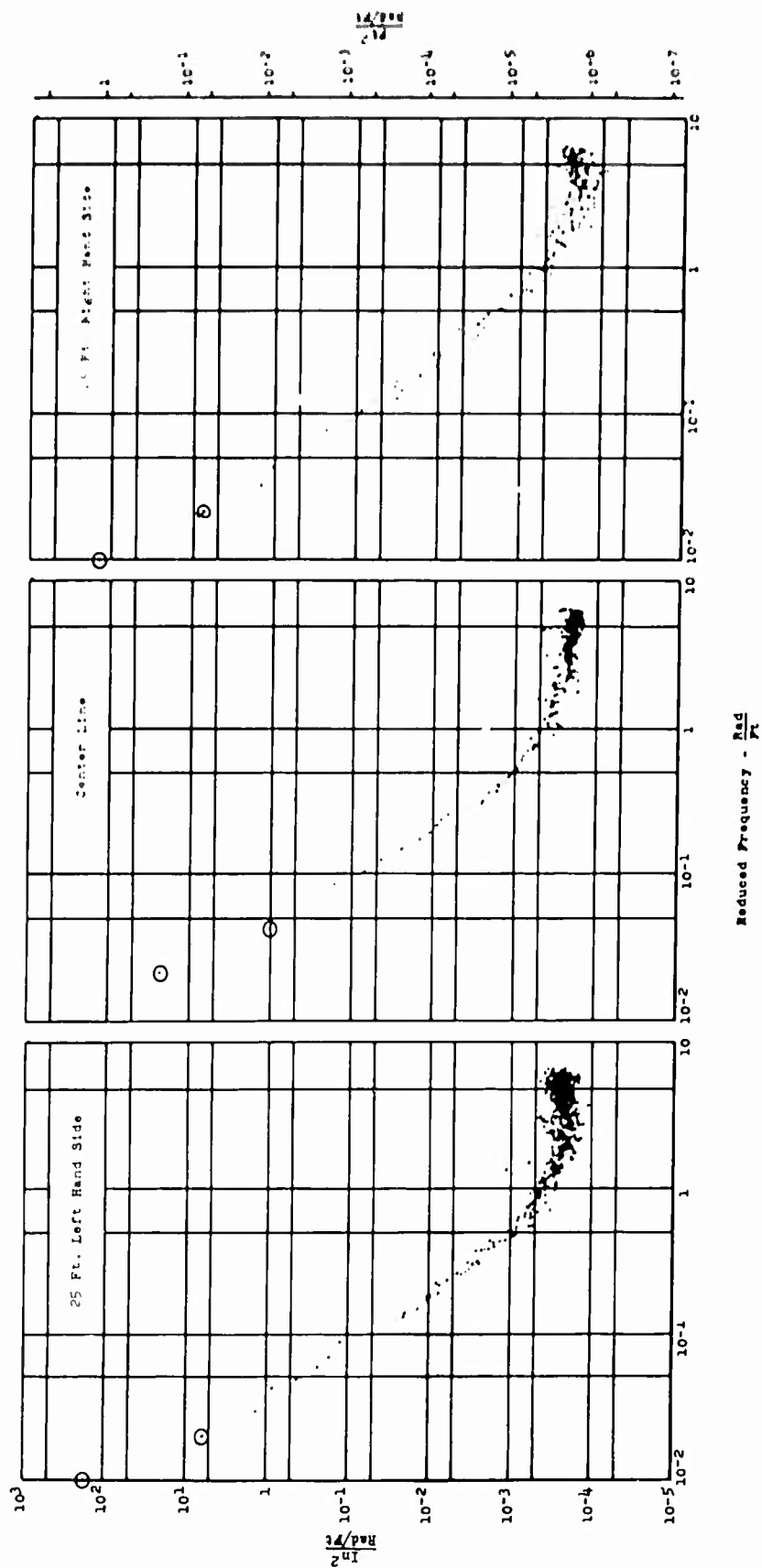


Figure 30 - Power Spectral Density, Taxiway 5, George Air Force Base

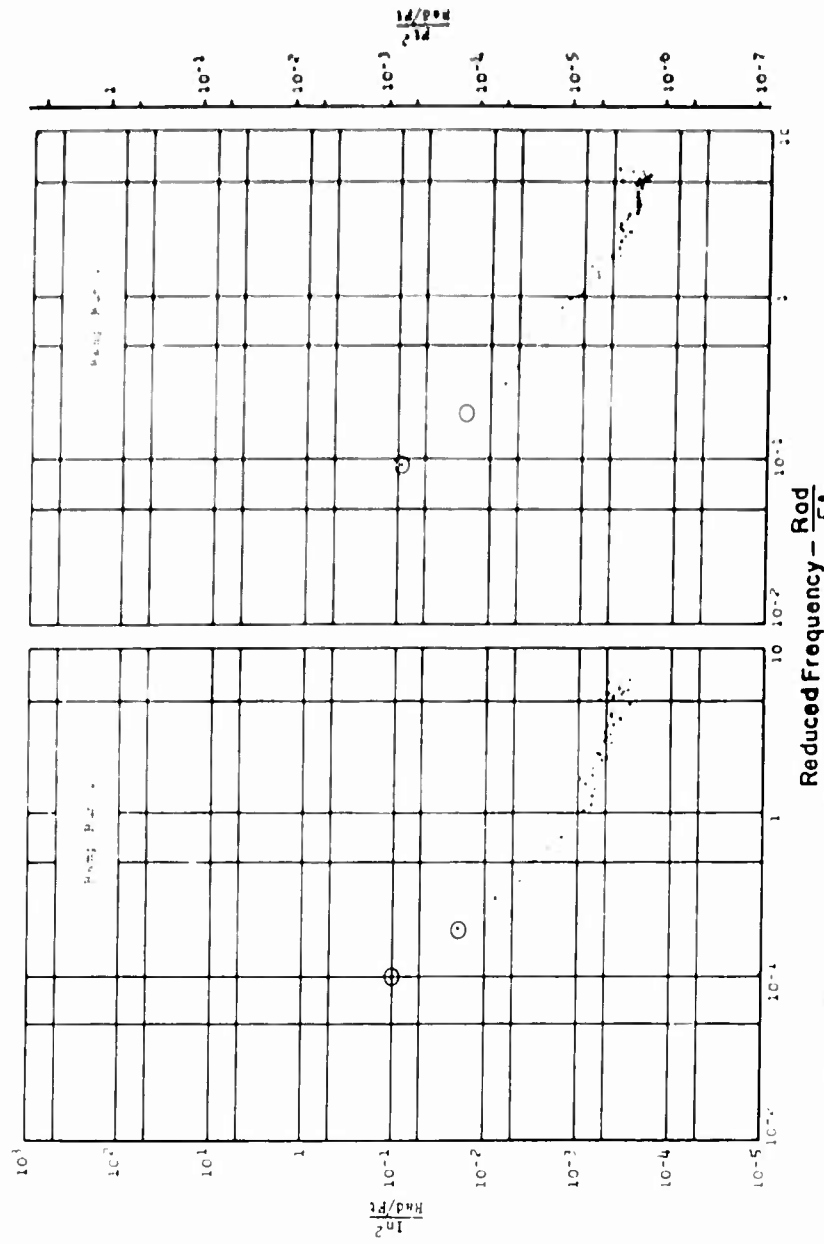


Figure 31 - Power Spectral Density, George Air Force Base

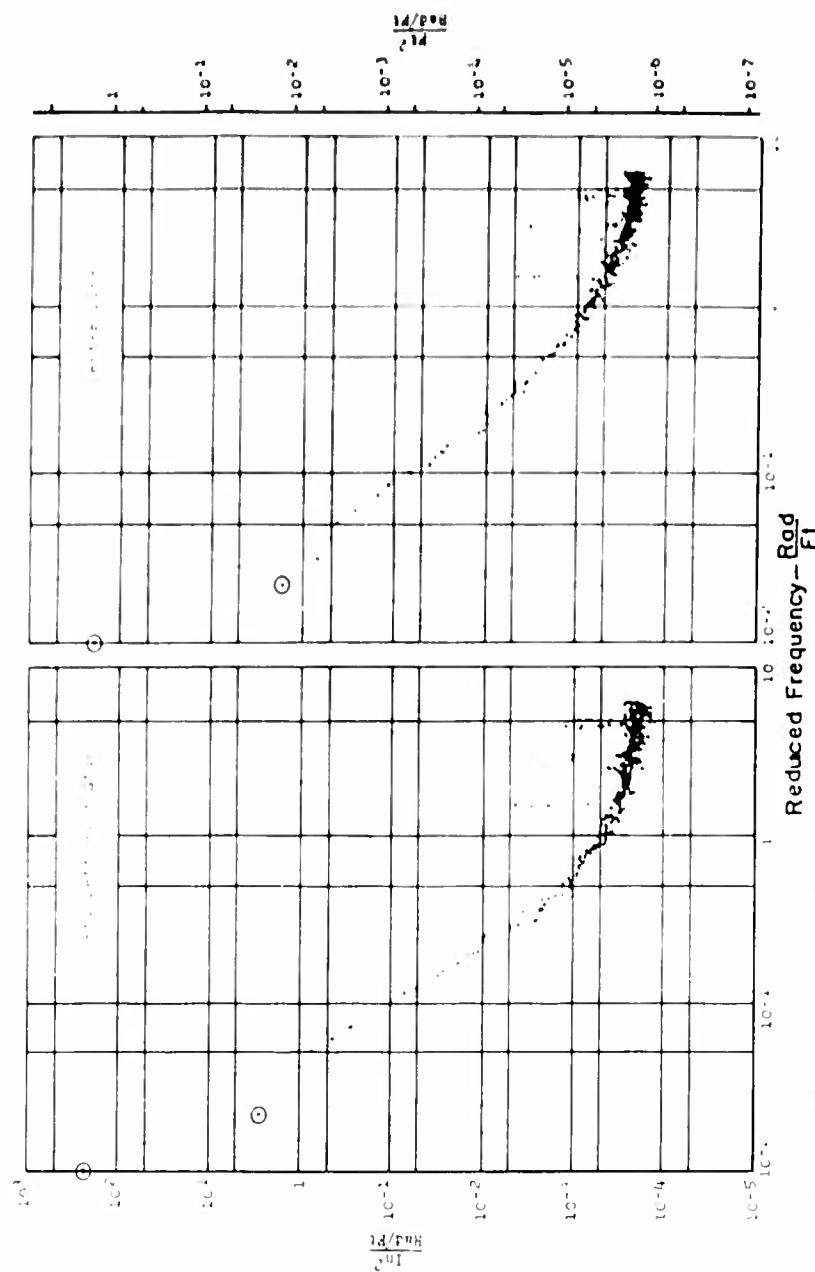


Figure 32 - Power Spectral Density, Runway 10, Glasgow Air Force Base

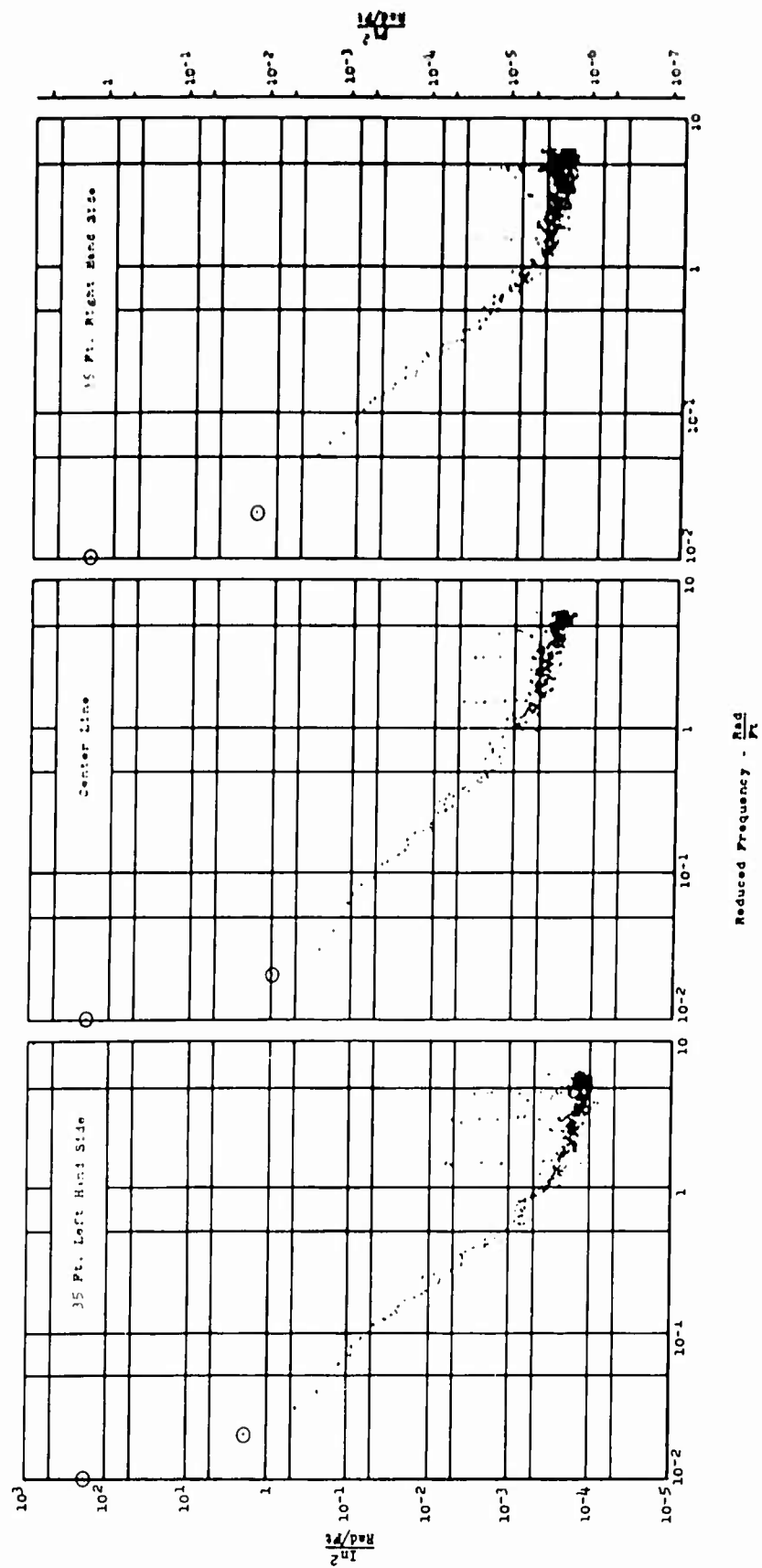


Figure 33 - Power Spectral Density, Taxiway 10, Glasgow Air Force Base

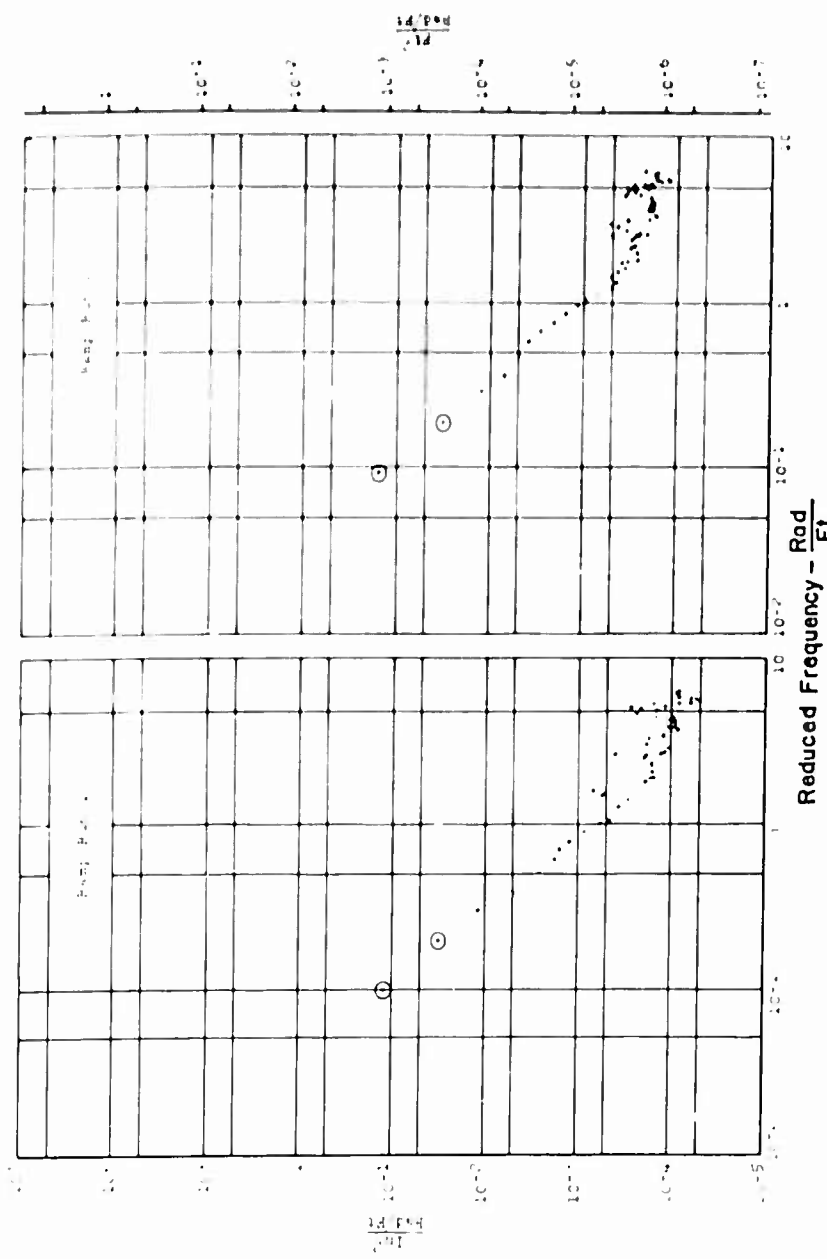


Figure 34 - Power Spectral Density, Glasgow Air Force Base

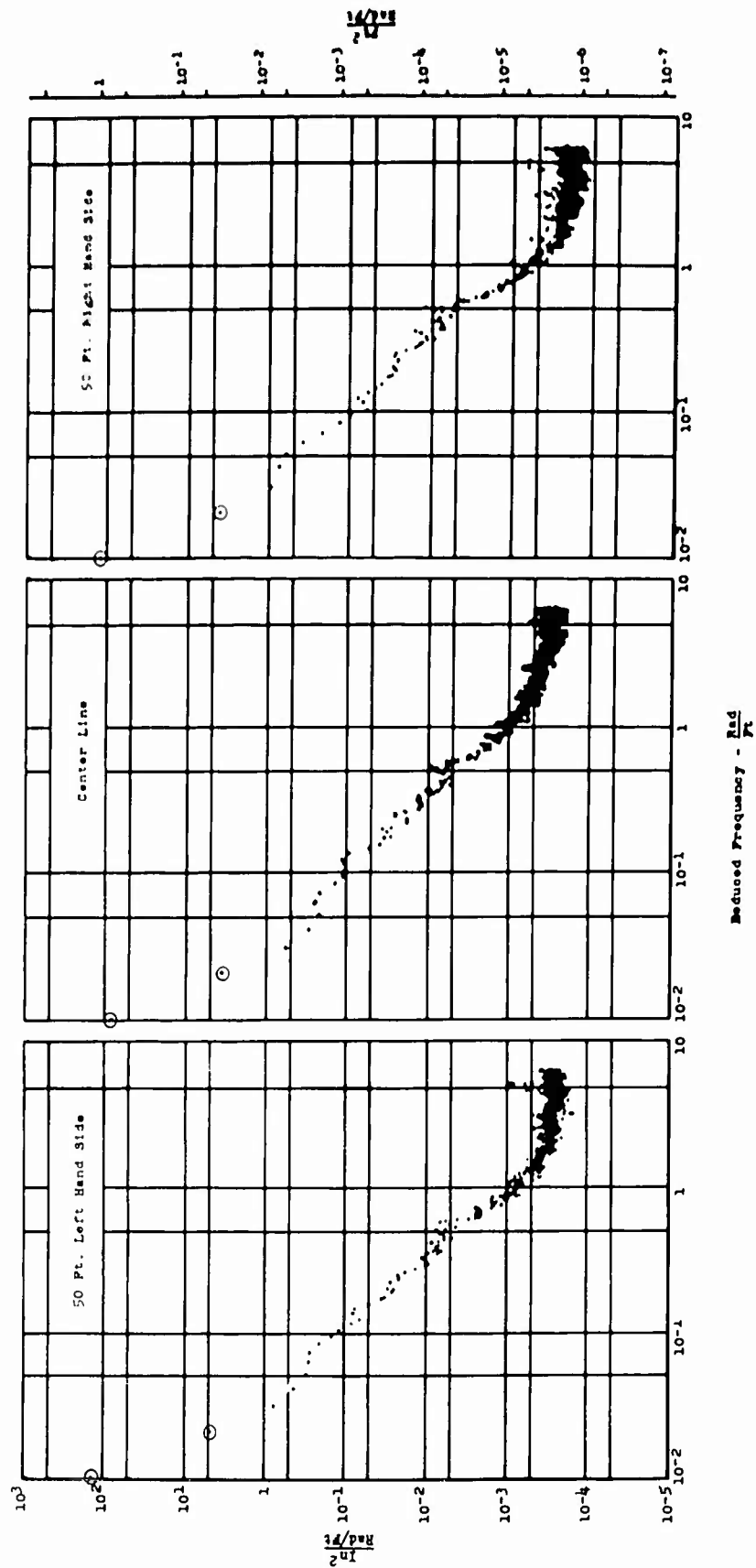


Figure 35 - Power Spectral Density, Runway 7, Langley Air Force Base

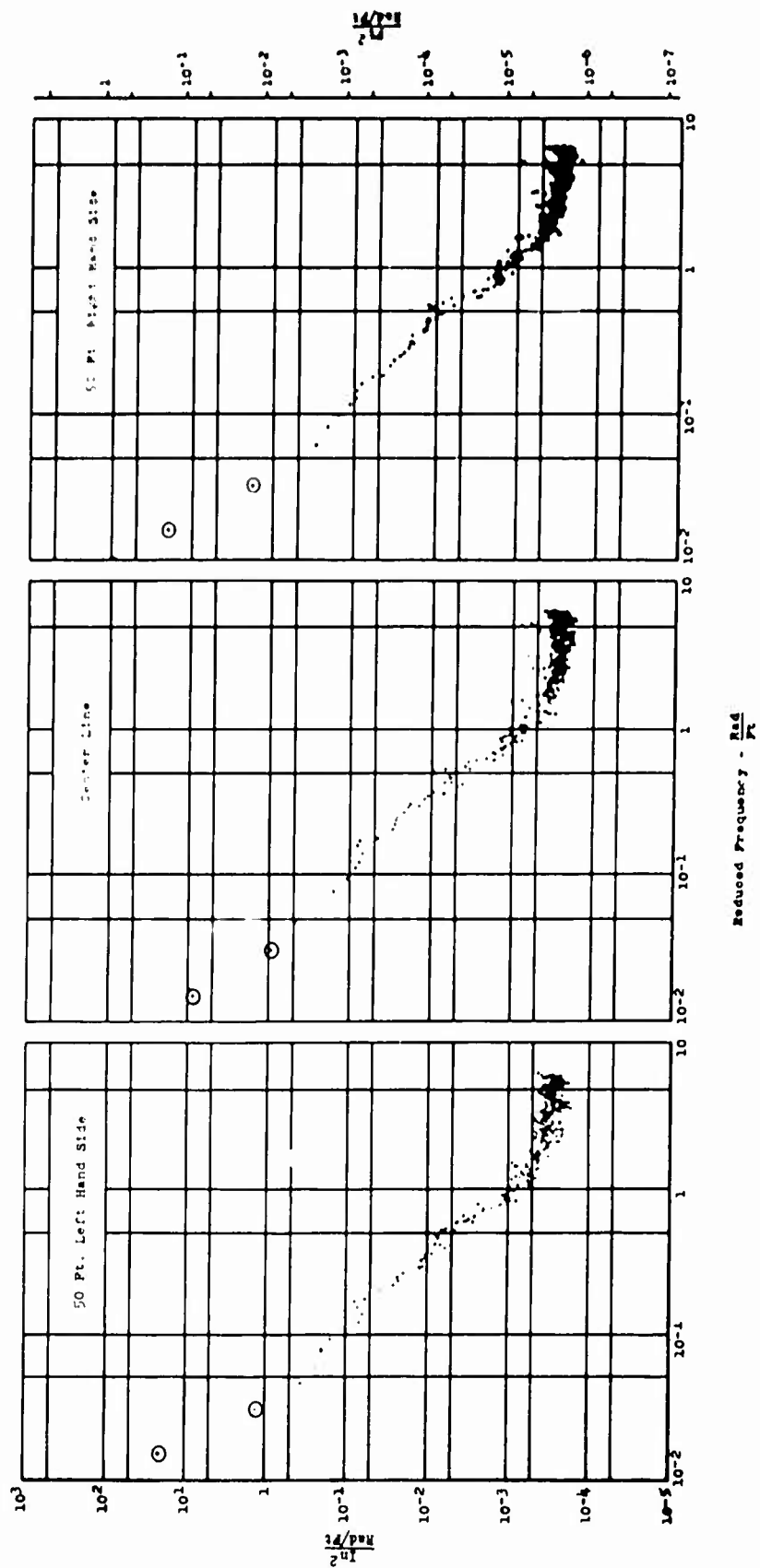


Figure 36 - Power Spectral Density, Runway 35, Langley Air Force Base

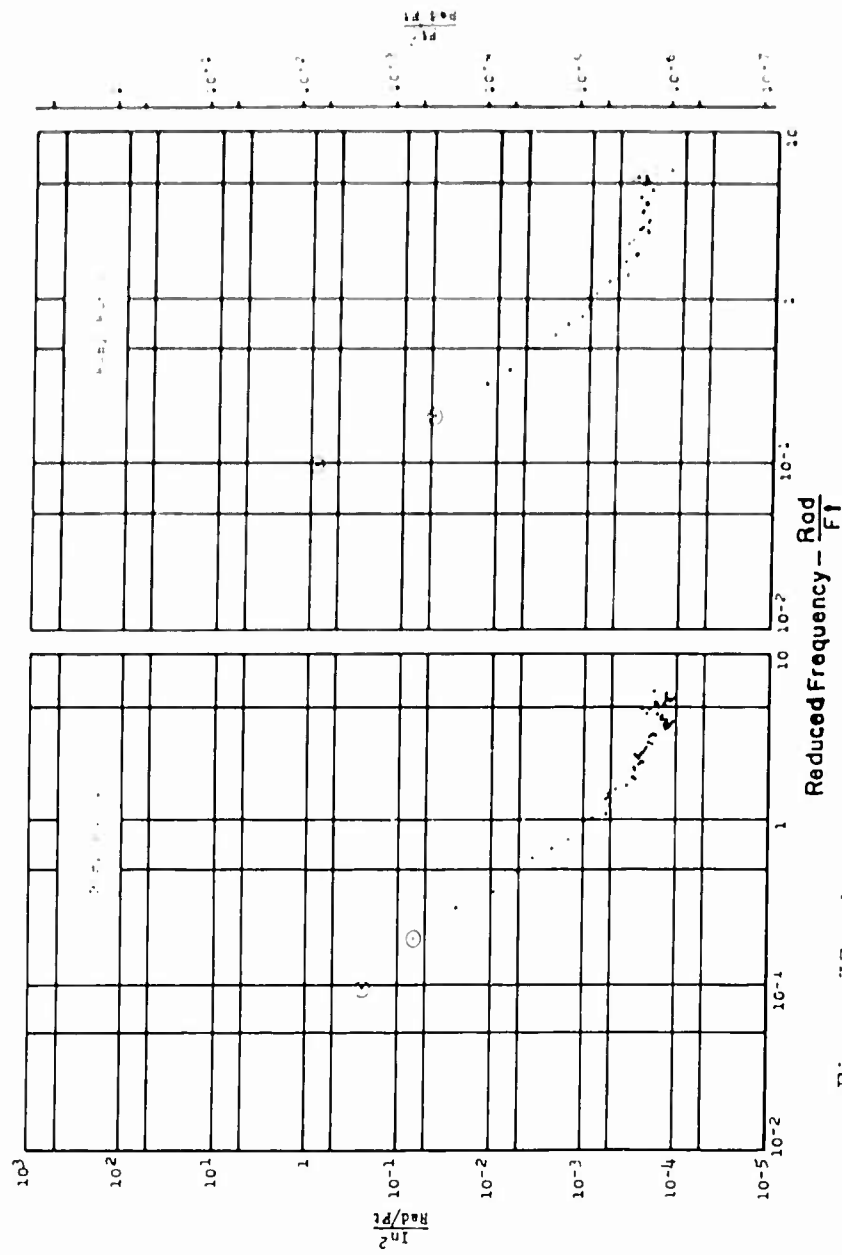


Figure 37 - Lower Spectral Density, Langley Air Force Base

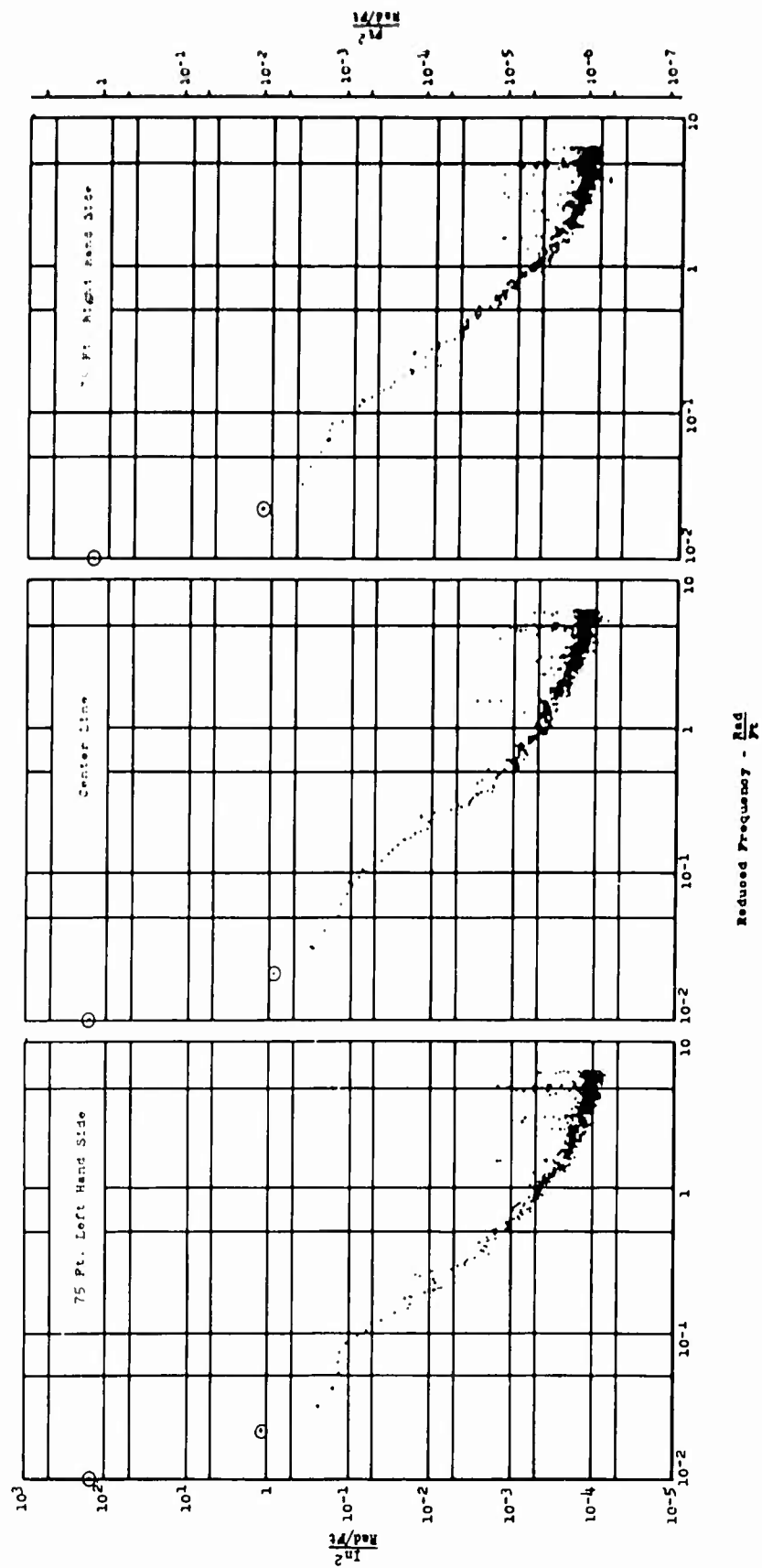


Figure 38 - Power Spectral Density, Runway 32, Larson Air Force Base

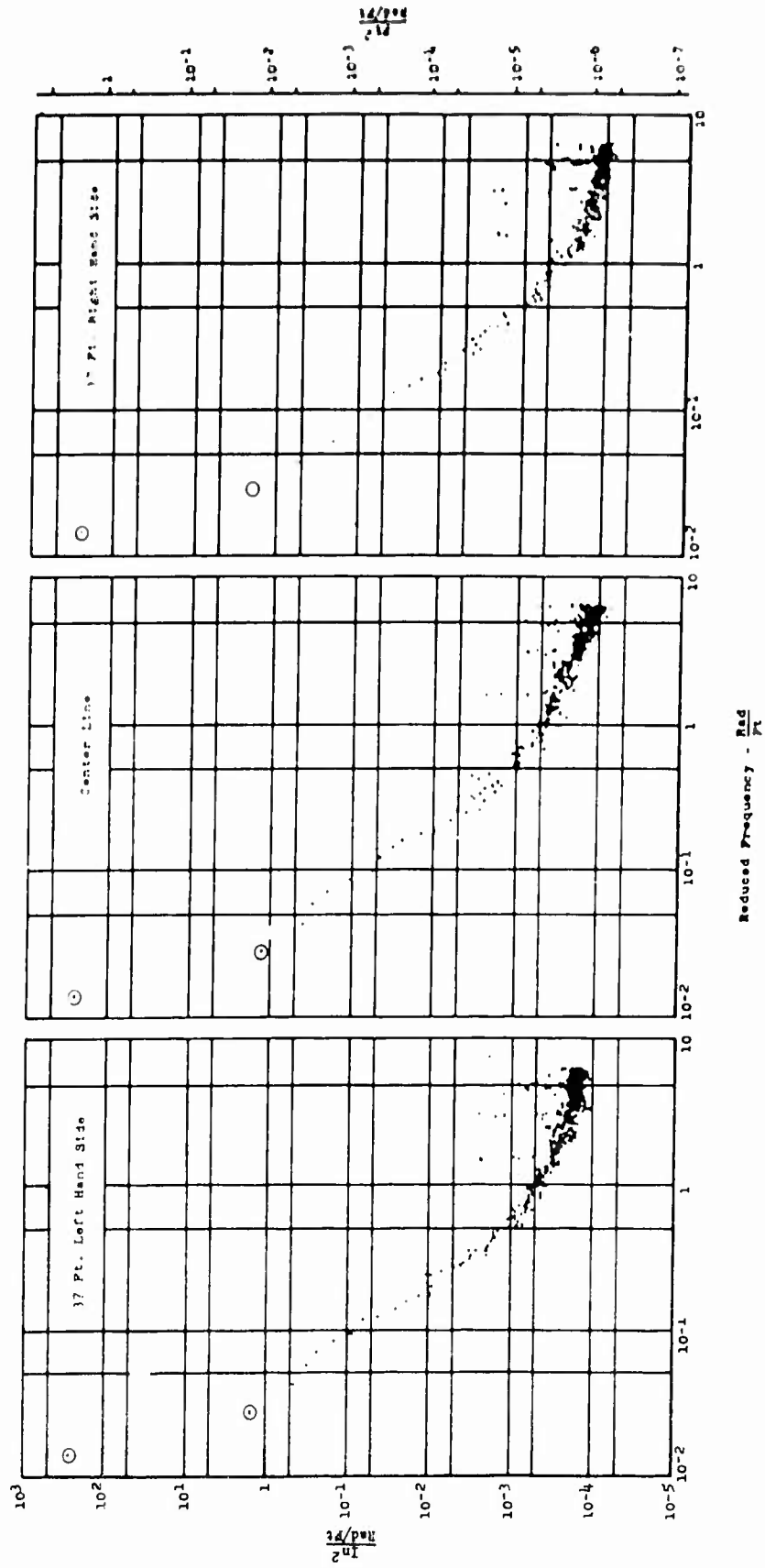


Figure 39 - Power Spectral Density, Taxiway 3, Larson Air Force Base

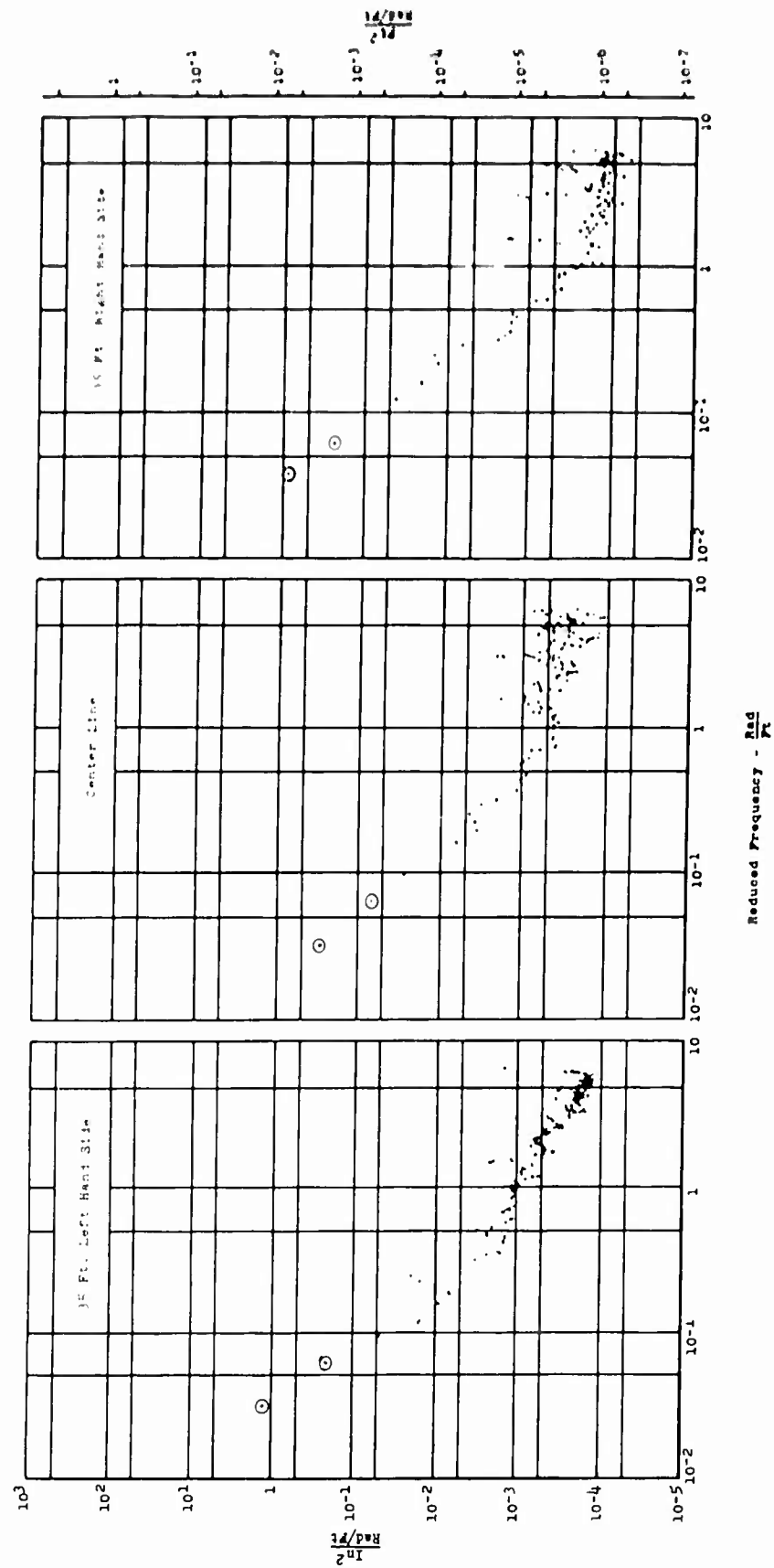


Figure 40 - Power Spectral Density, Taxiway 4, Larson Air Force Base

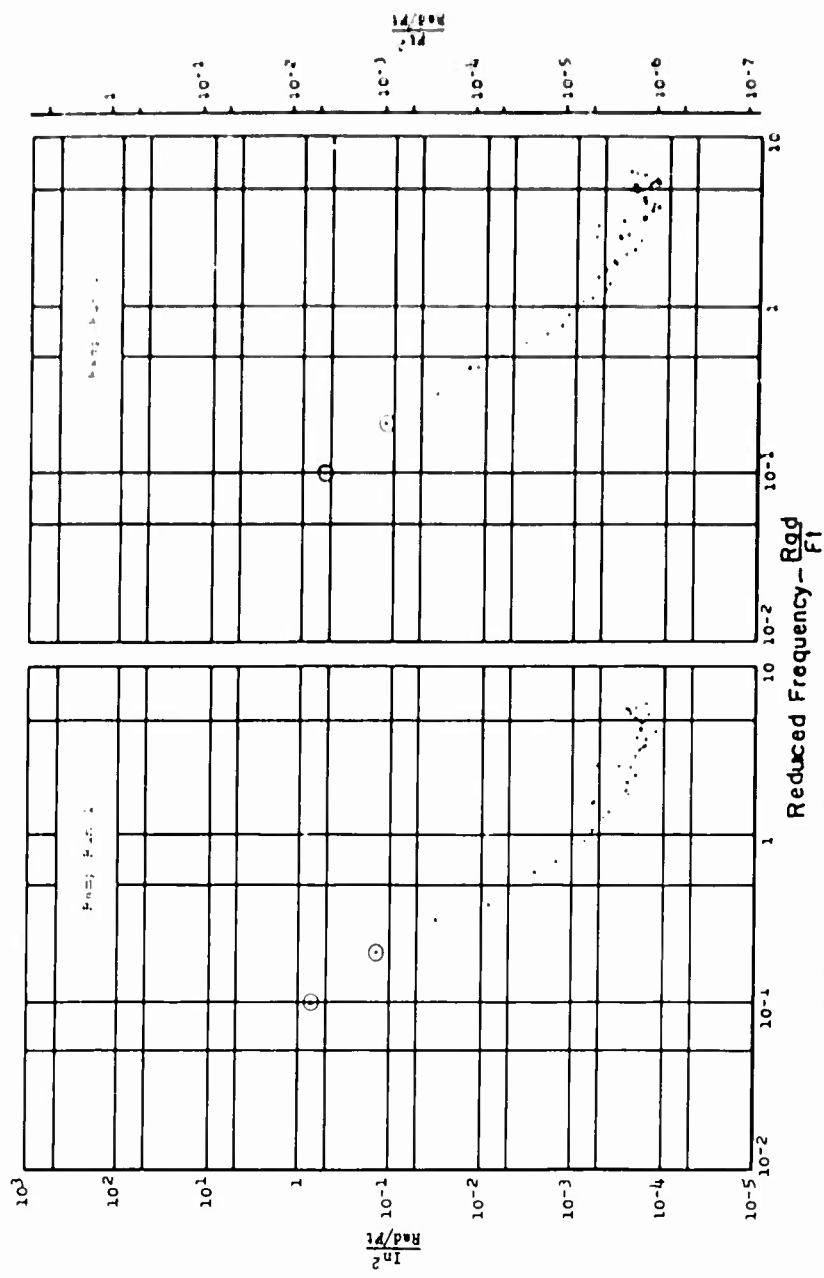


Figure 41 - Power Spectral Density, Larson Air Force Base

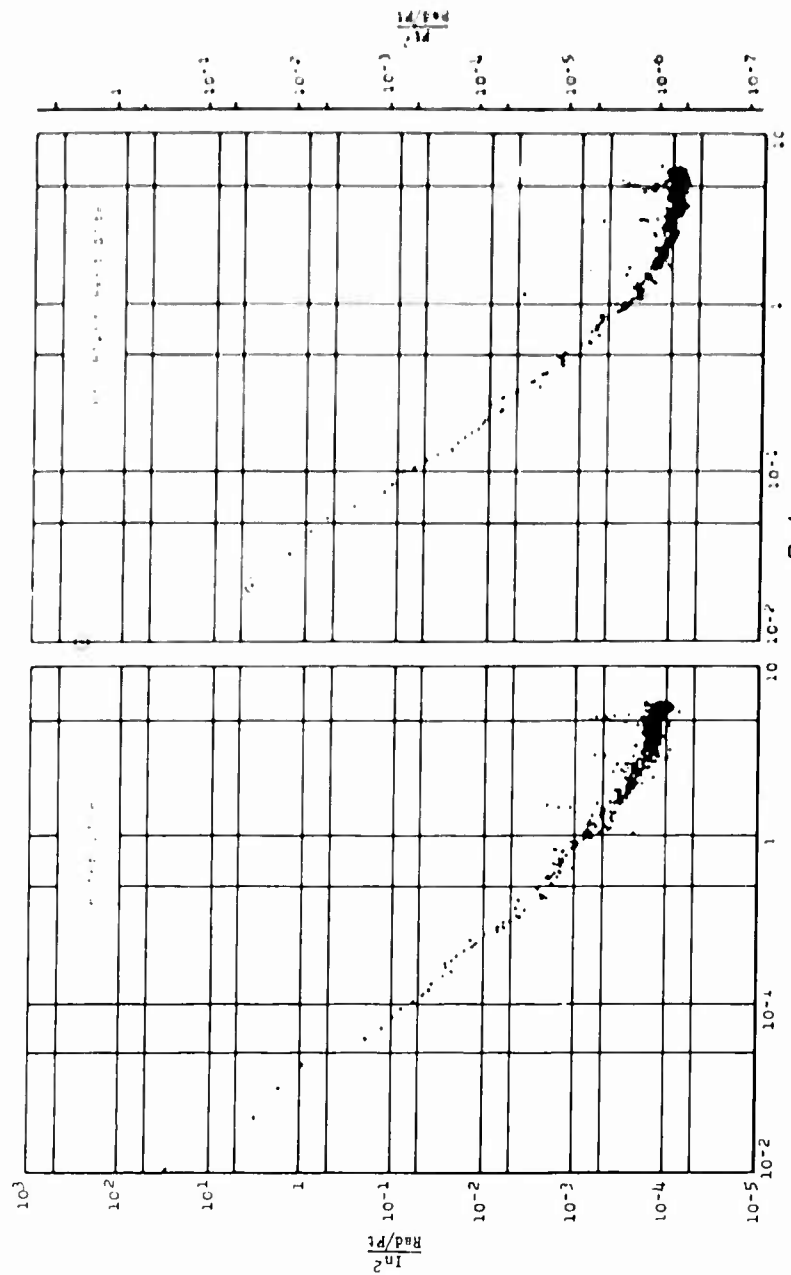


Figure 42 - Power Spectral Density, Runway 22 L, Mather Air Force Base

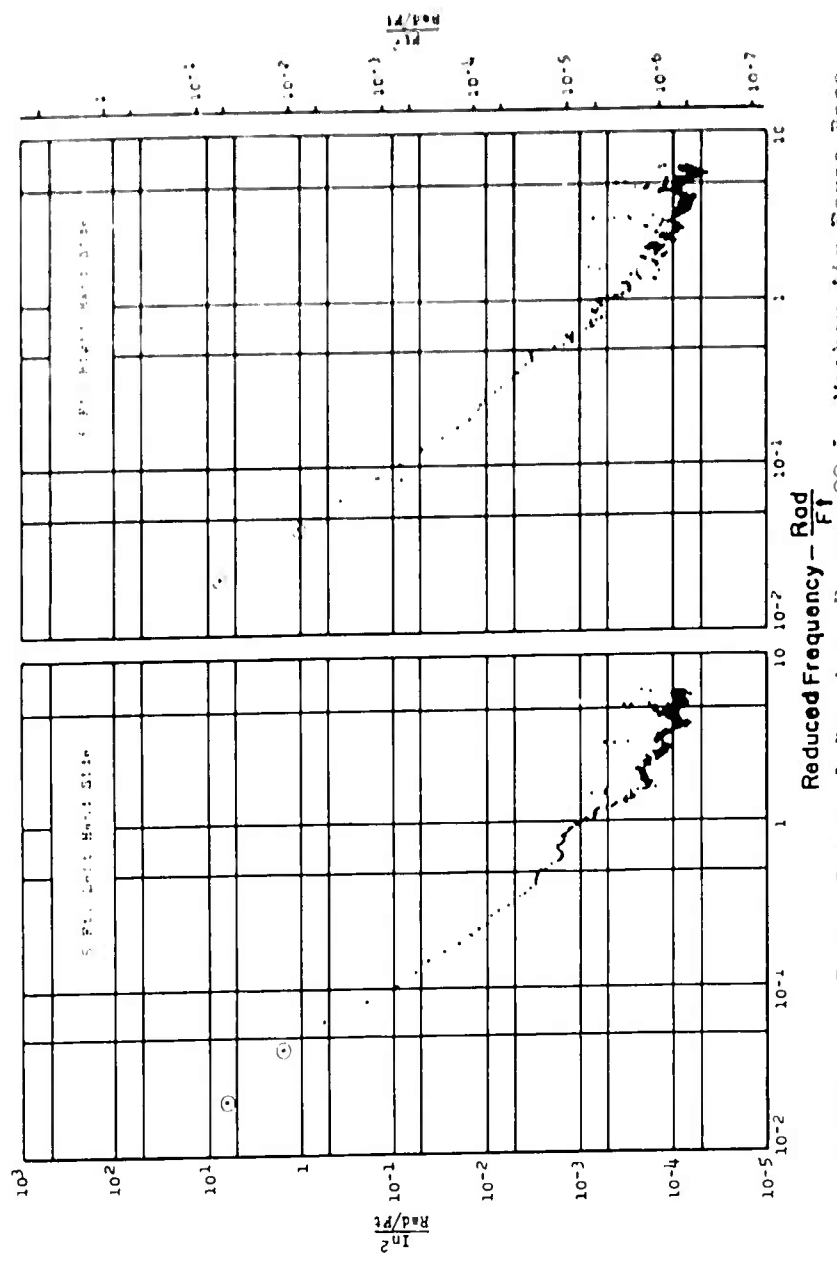


Figure 43 - Power Spectral Density, Runway 22 L, Mather Air Force Base

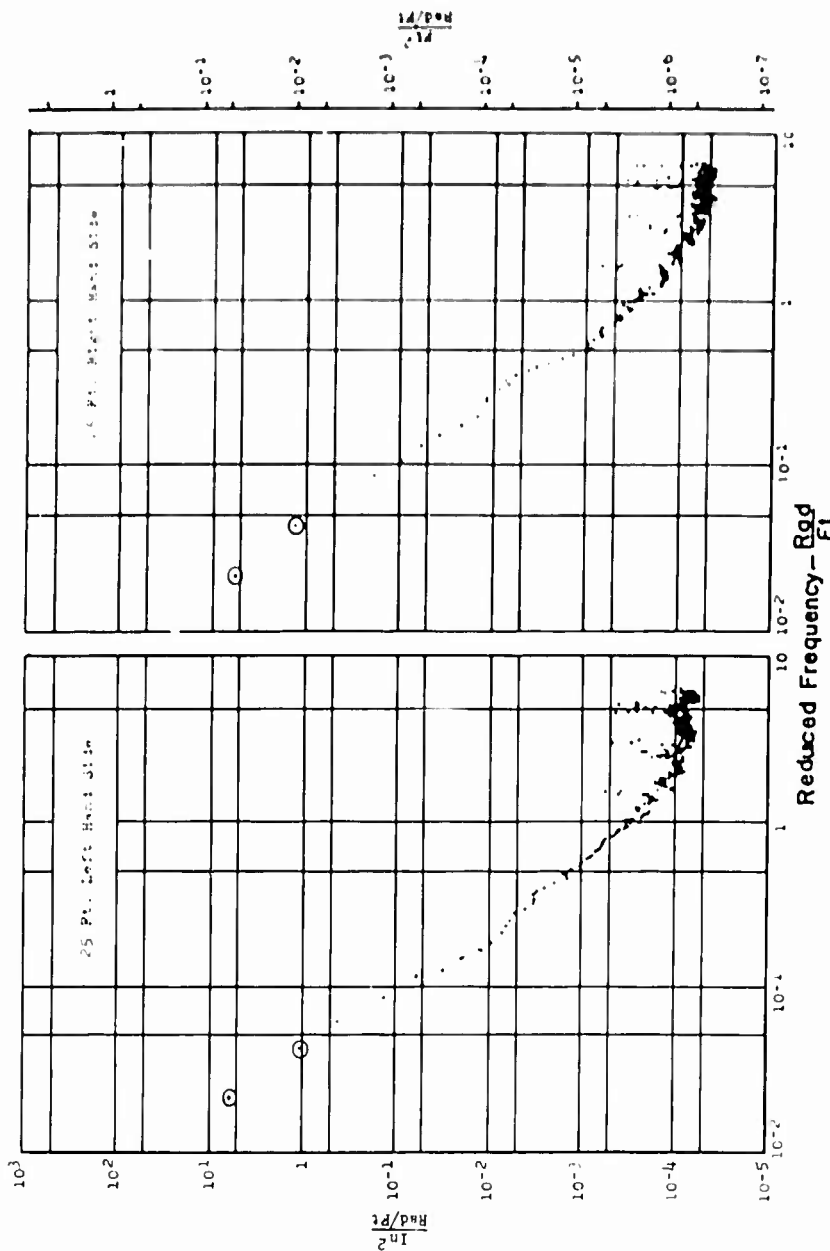


Figure 44 - Power Spectral Density, Runway 22 L, Mather Air Force Base

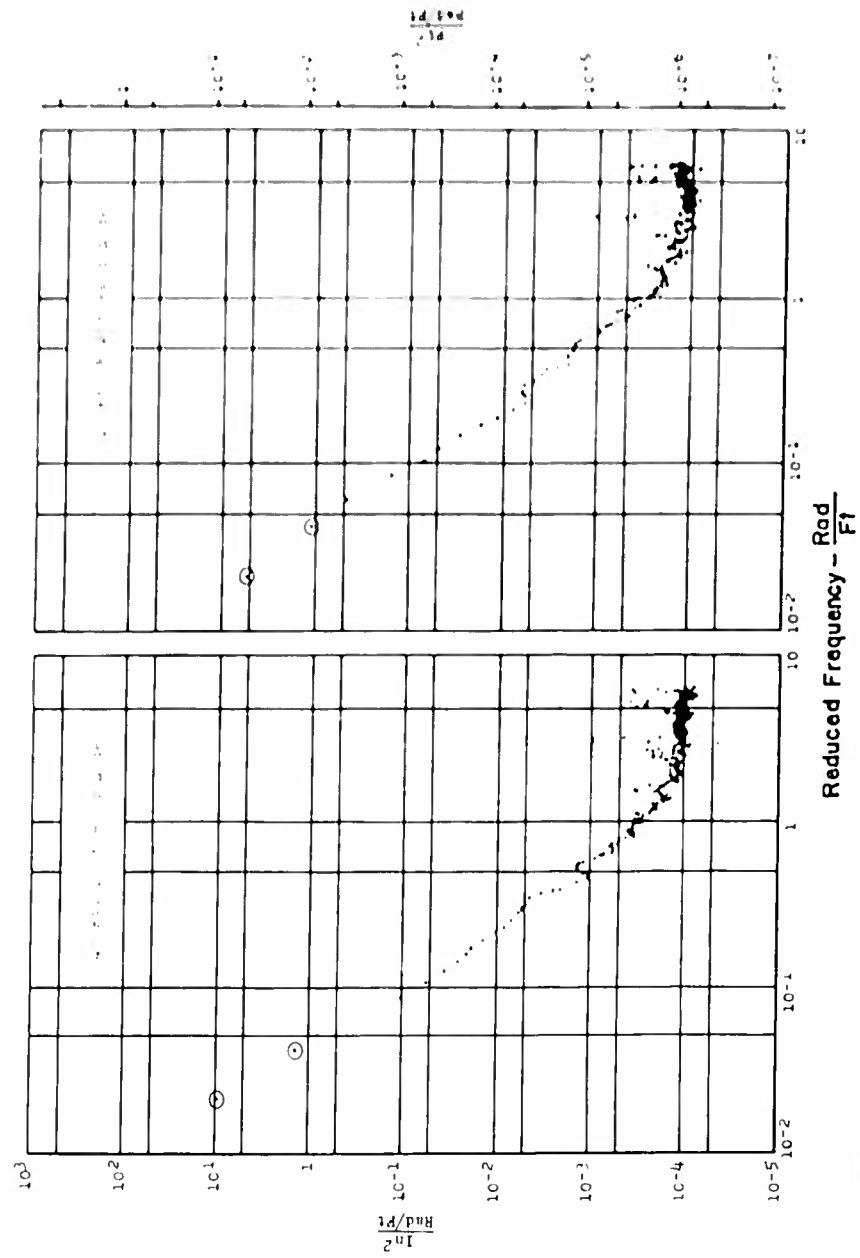


Figure 45 - Power Spectral Density, Runway 22 L, Mather Air Force Base

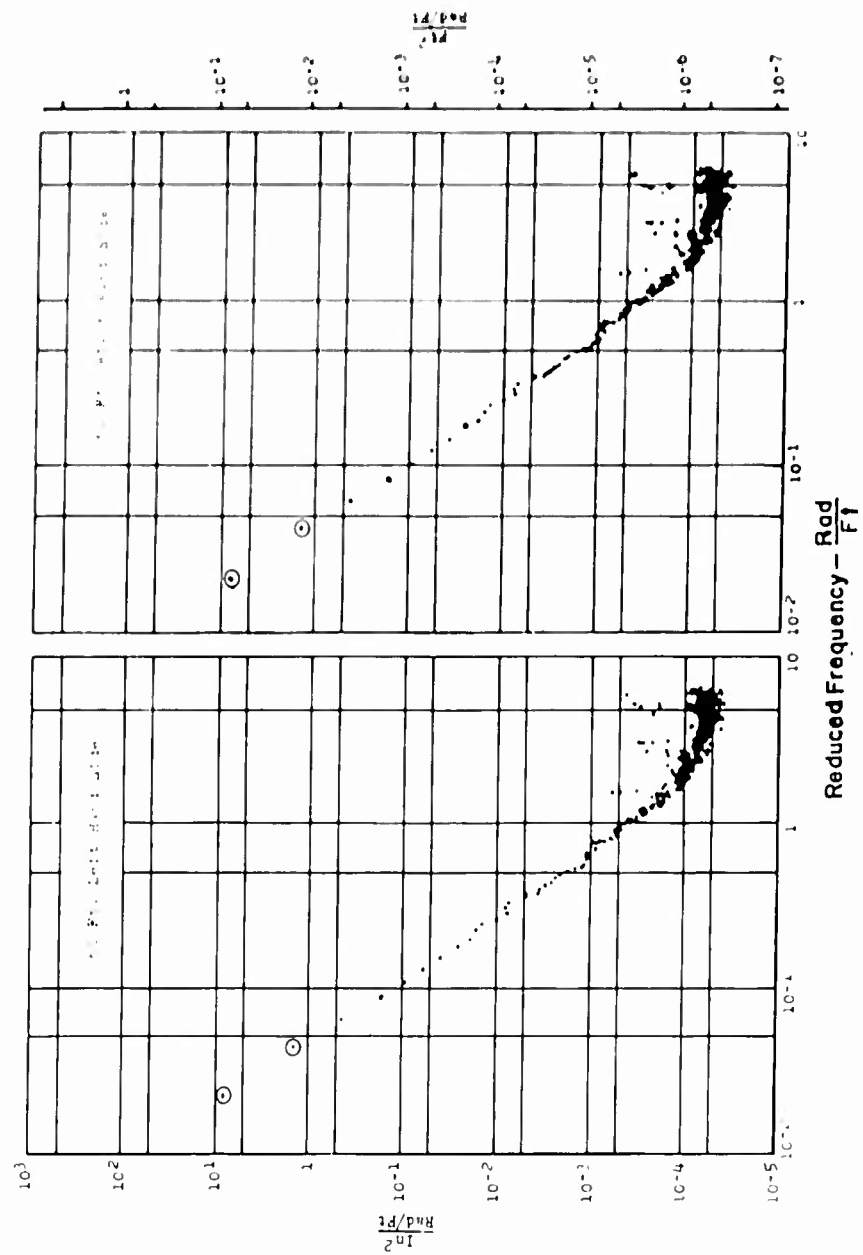


Figure 46 - Power Spectral Density, Runway 22 L, Mather Air Force Base

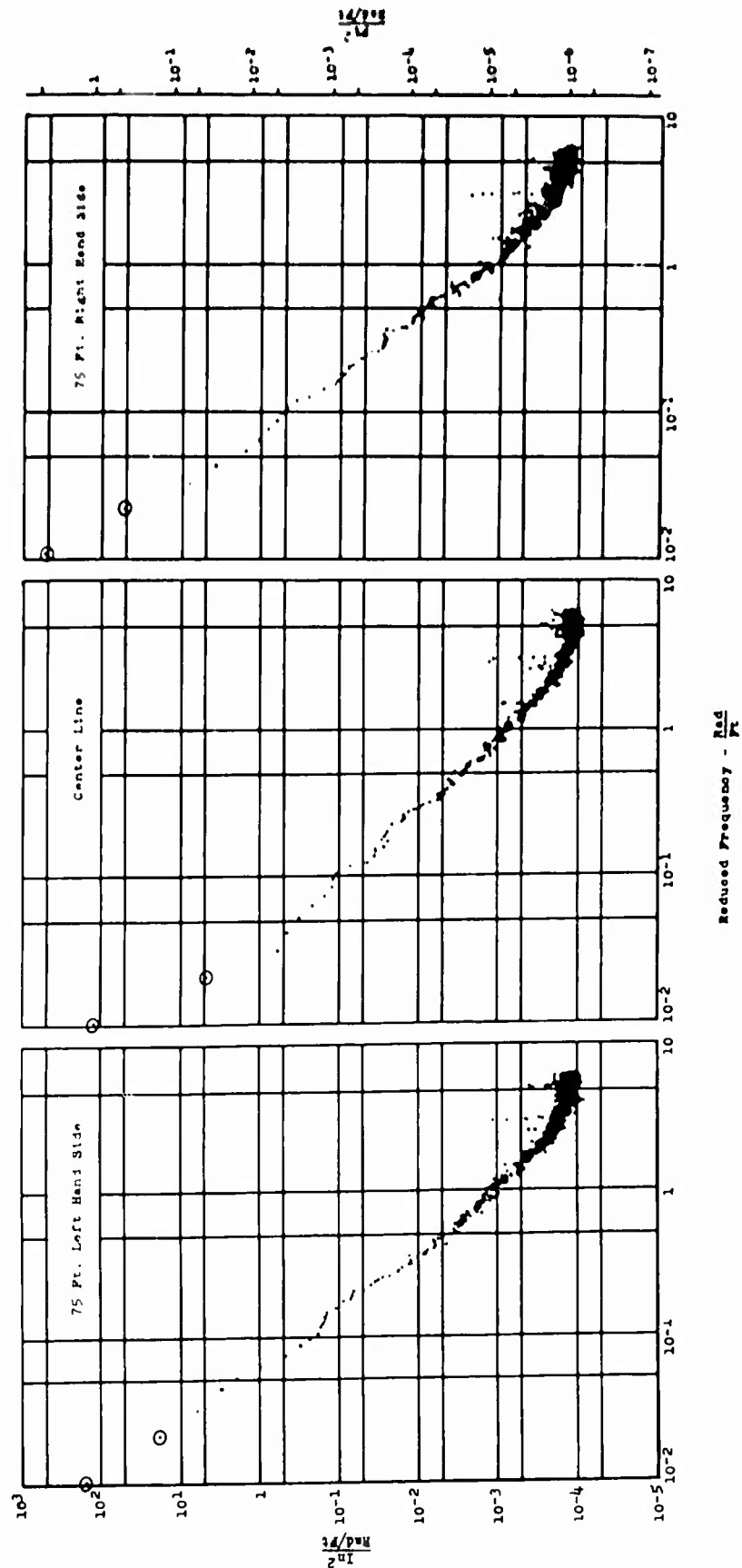


Figure 47 - Power Spectral Density, Taxiway 22, Mather Air Force Base

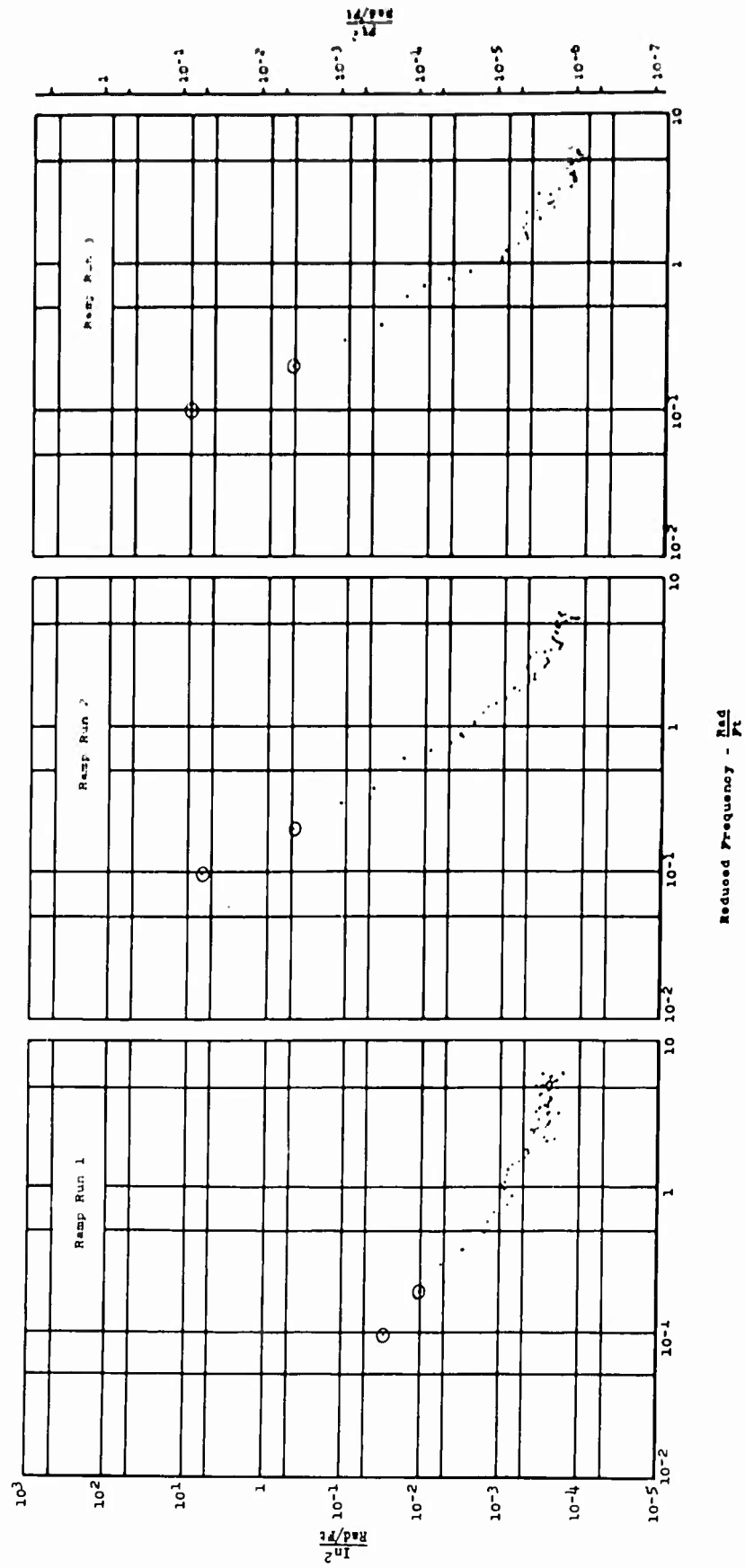


Figure 48 - Power Spectral Density, Mather Air Force Base

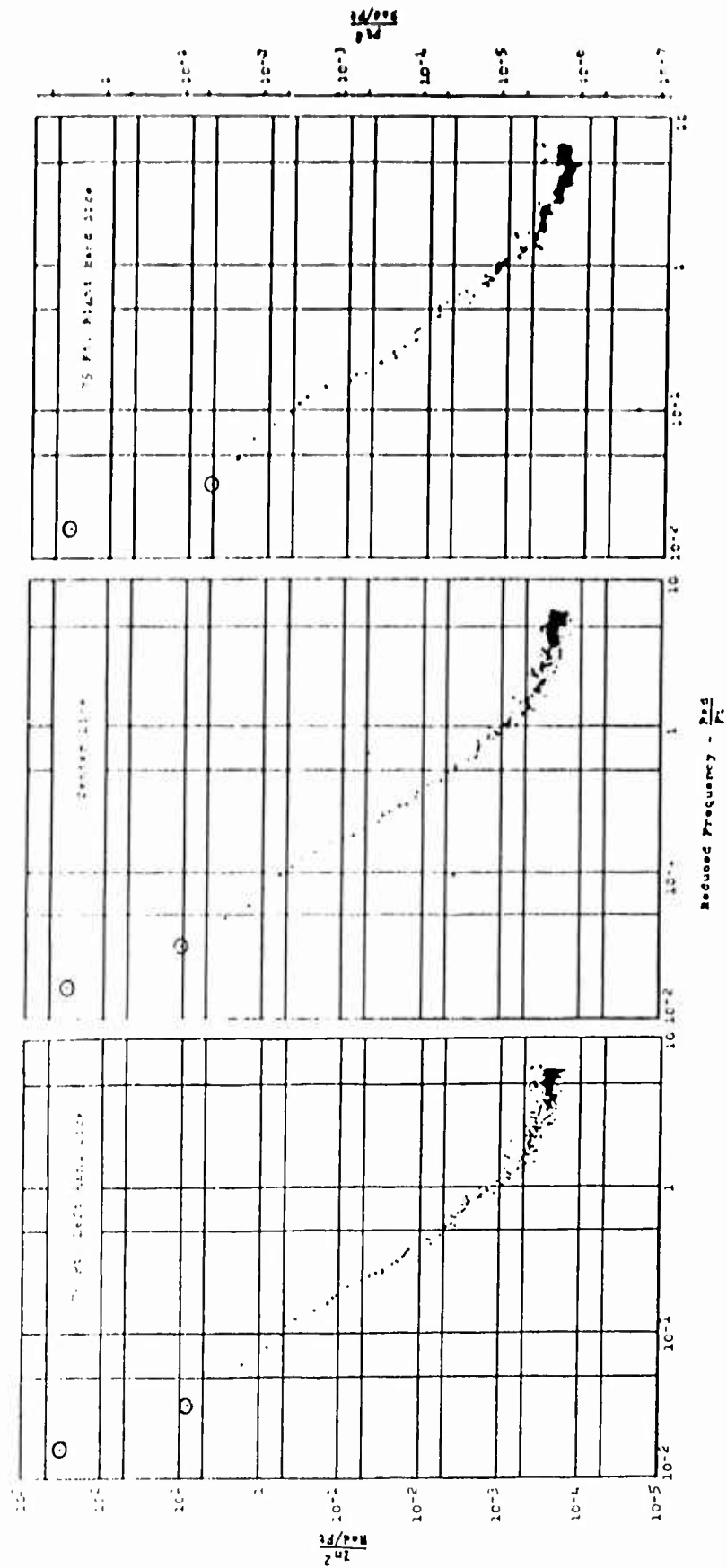


Figure 49 - Power Spectral Density, Runway 12, McGuire Air Force Base

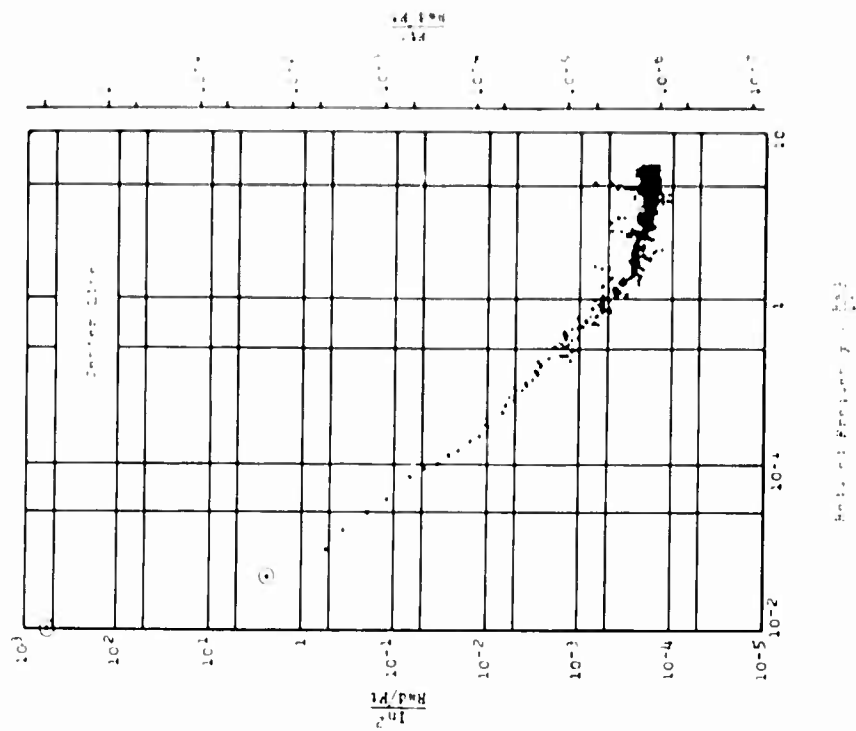


Figure 50 - Power Spectral Density, Runway 6, McGuire Air Force Base

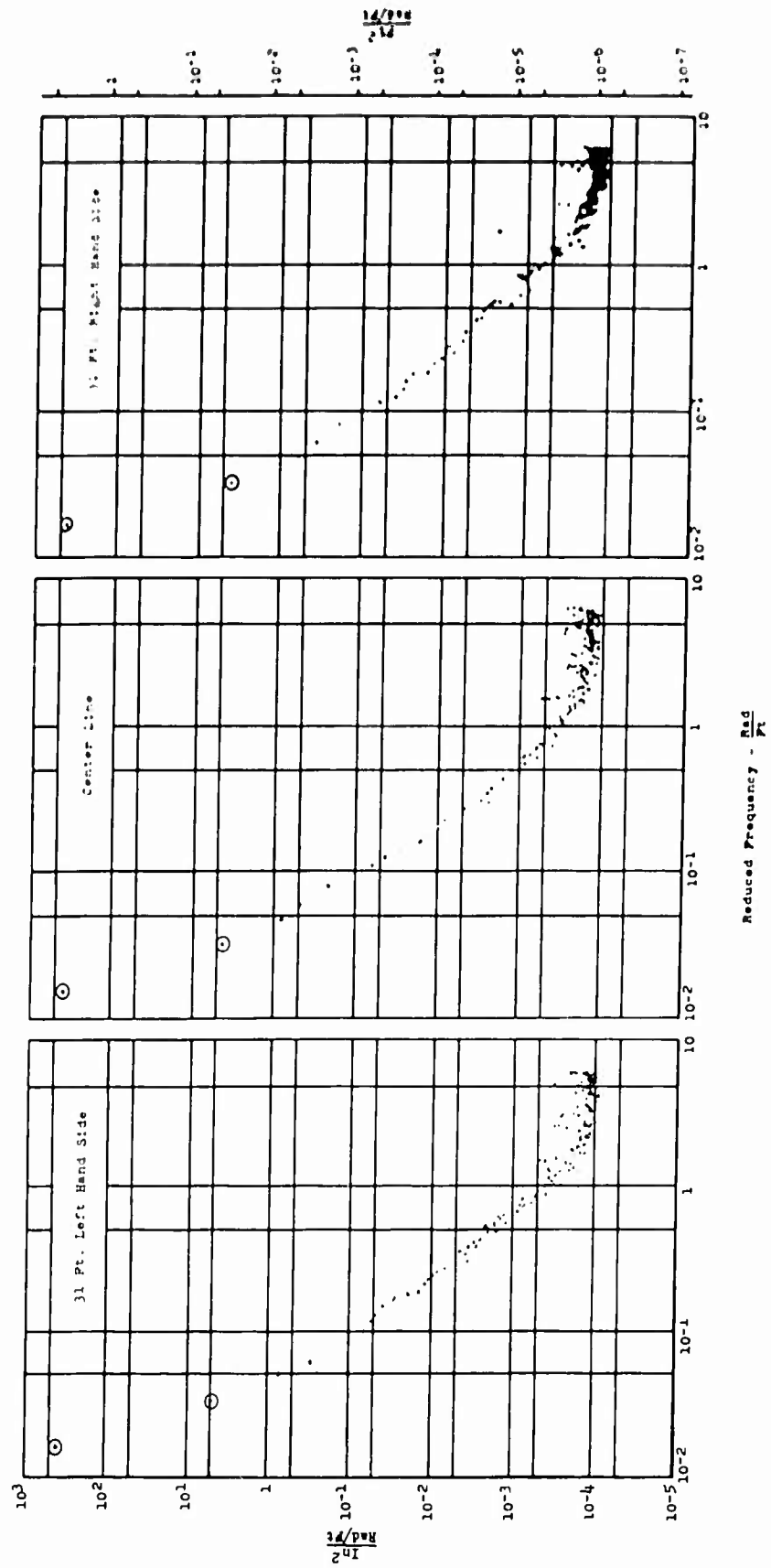


Figure 51 - Power Spectral Density, Taxiway 5, McGuire Air Force Base

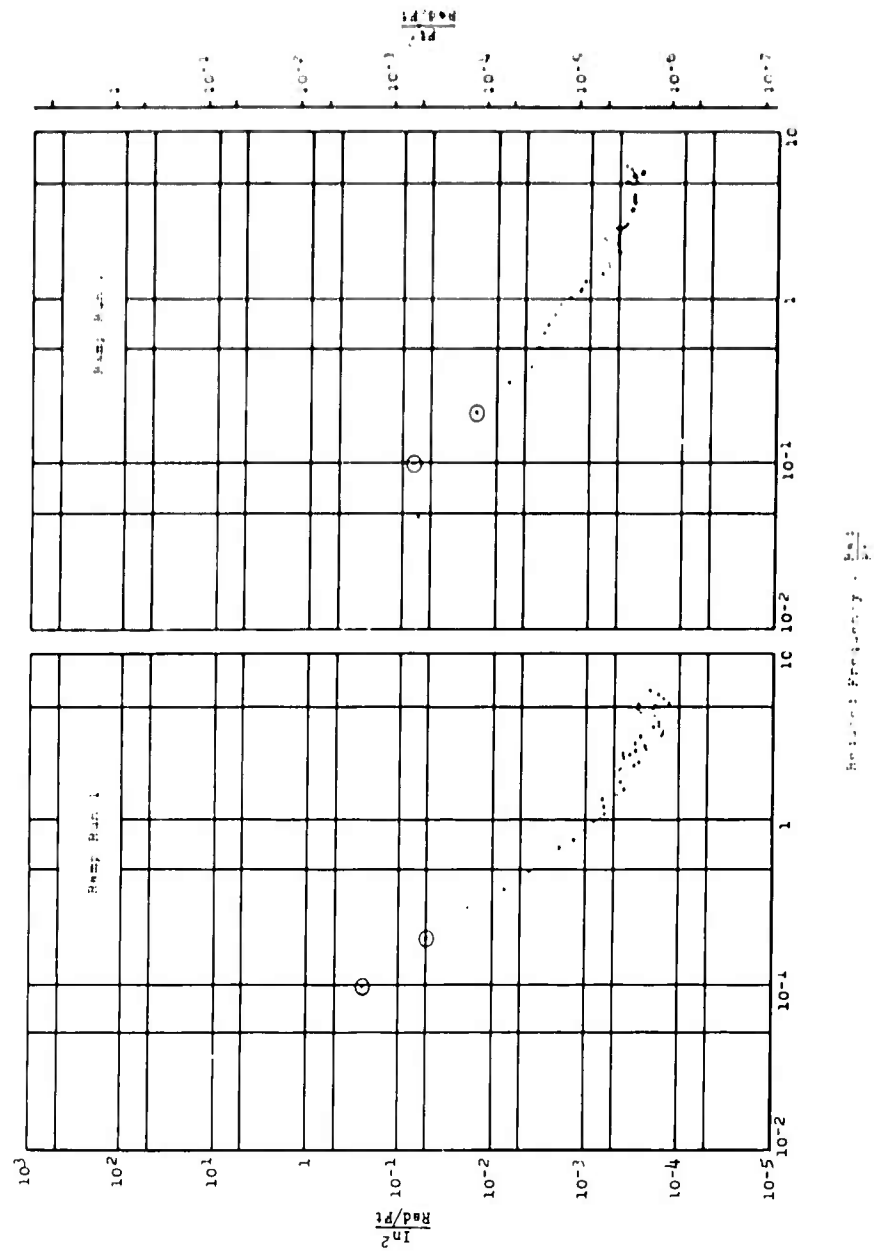


Figure 52 - Power Spectral Density, McGuire Air Force Base

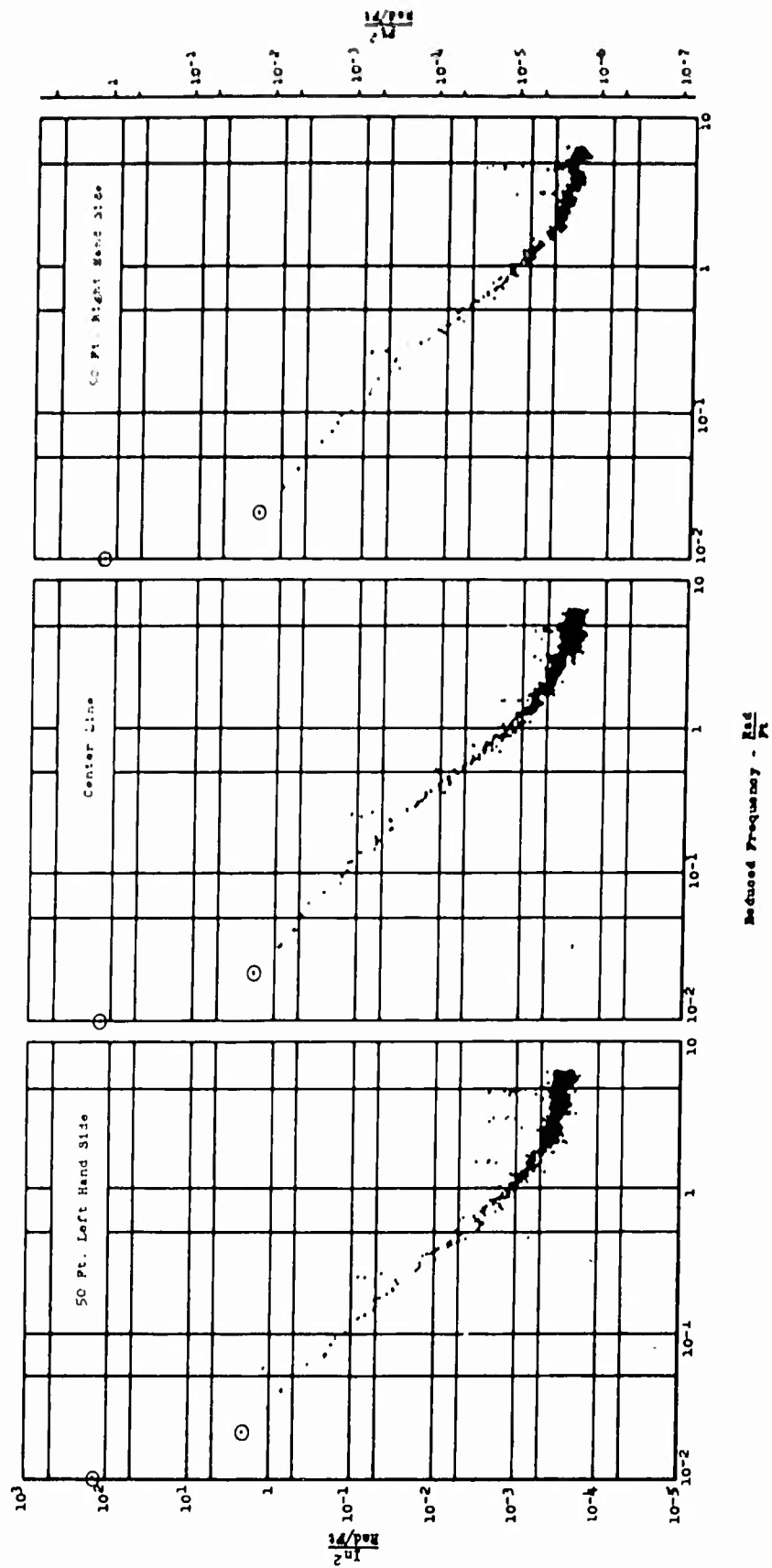


Figure 53 - Power Spectral Density, Runway 7, Palmdale Air Force Plant NR42

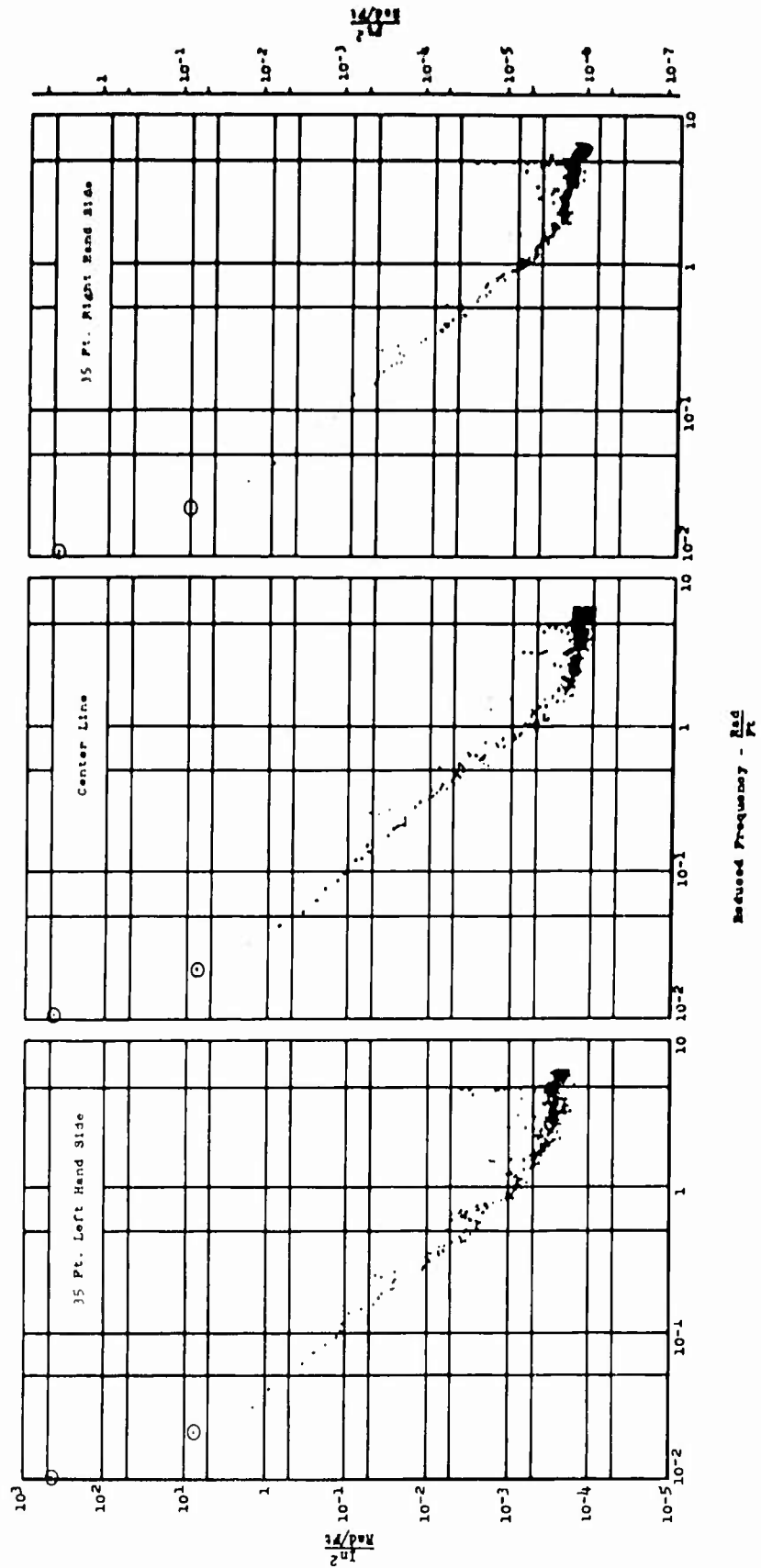


Figure 54 - Power Spectral Density, Taxiway B, Palmdale Air Force Plant NR42

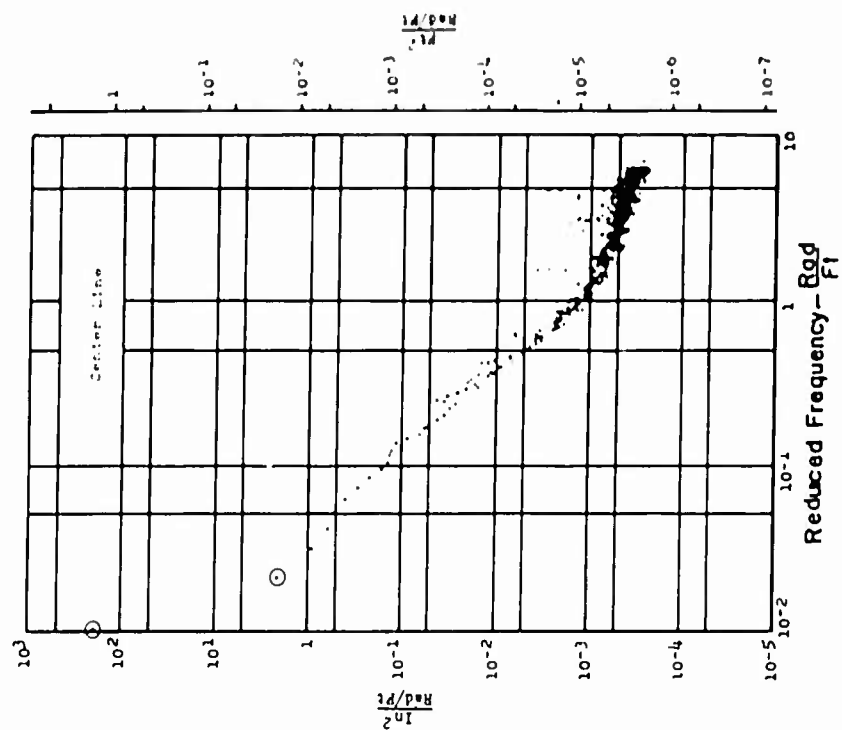


Figure 55 - Power Spectral Density, Runway 22, Palmdale Air Force Base, 1942

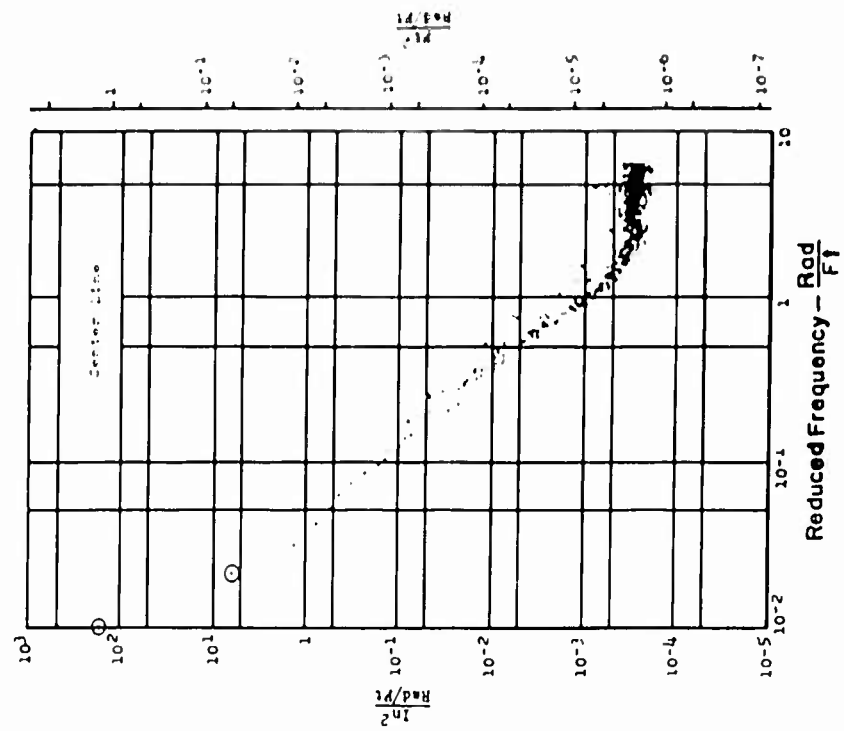


Figure 56 - Power Spectral Density, Taxiway E, Palmdale Air Force Plant 1342

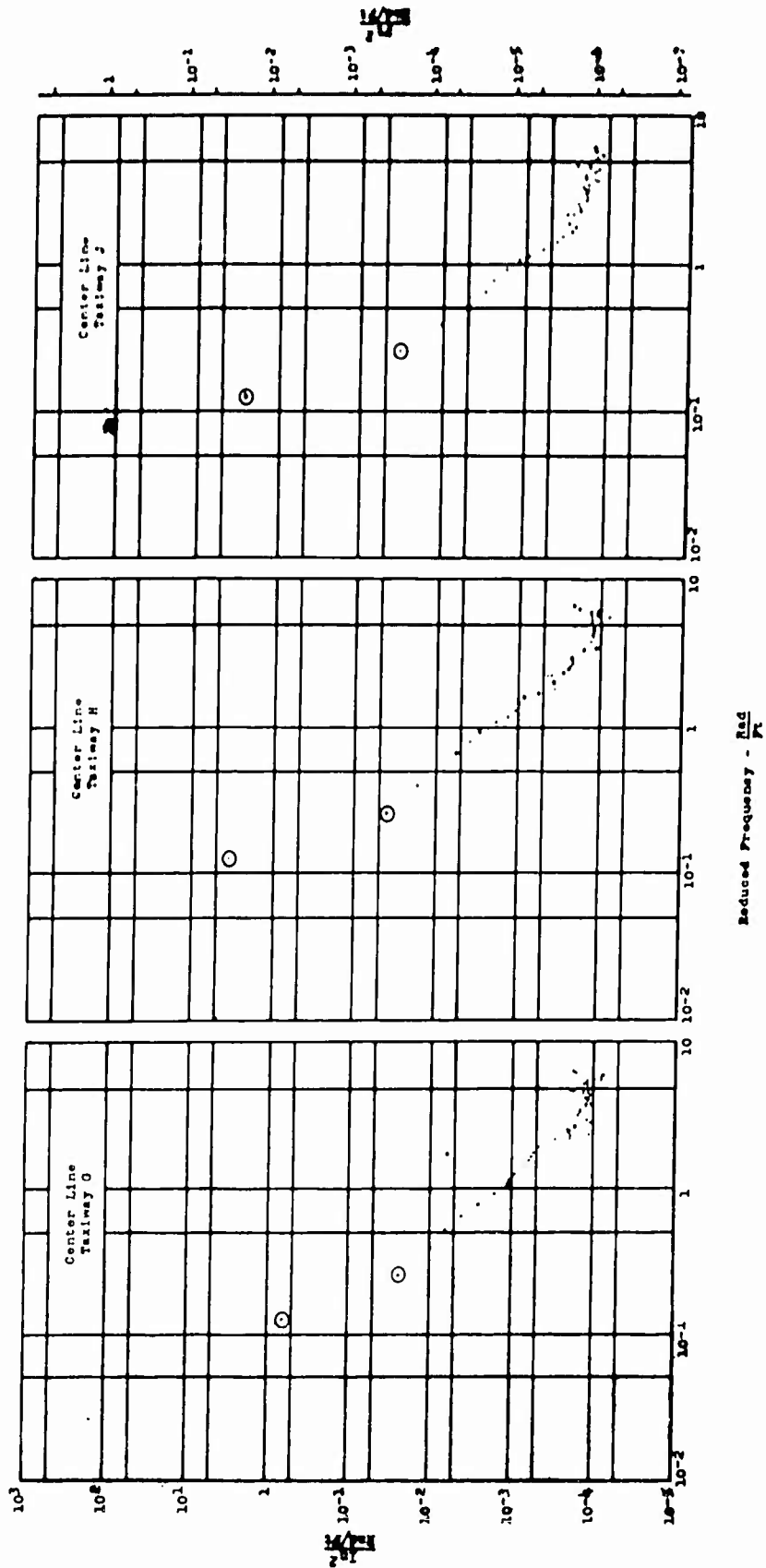


Figure 57 - Power Spectral Density, Palmdale Air Force Plant MR42

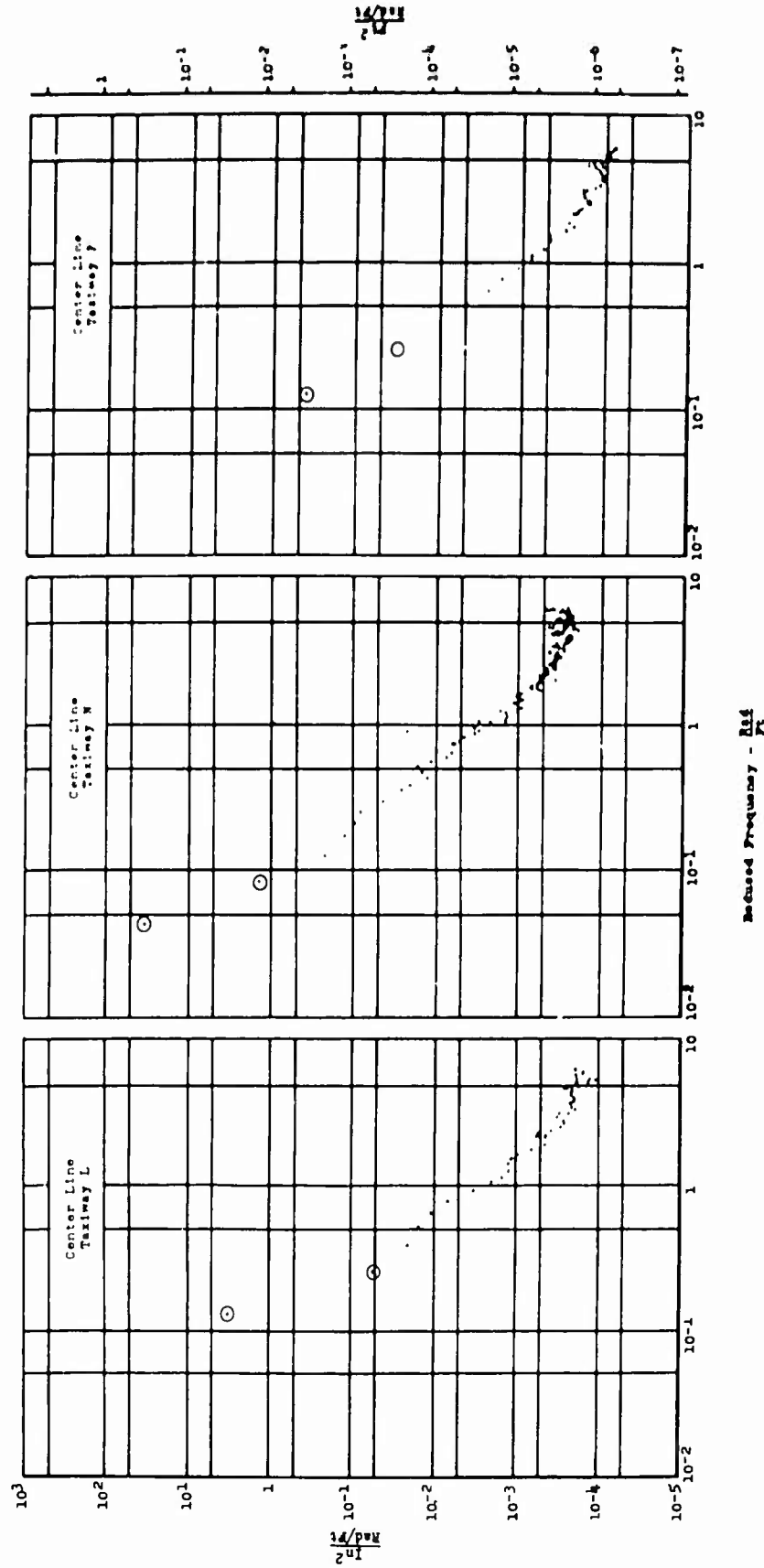


Figure 58 - Power Spectral Density, Palmdale Air Force Plant MR42

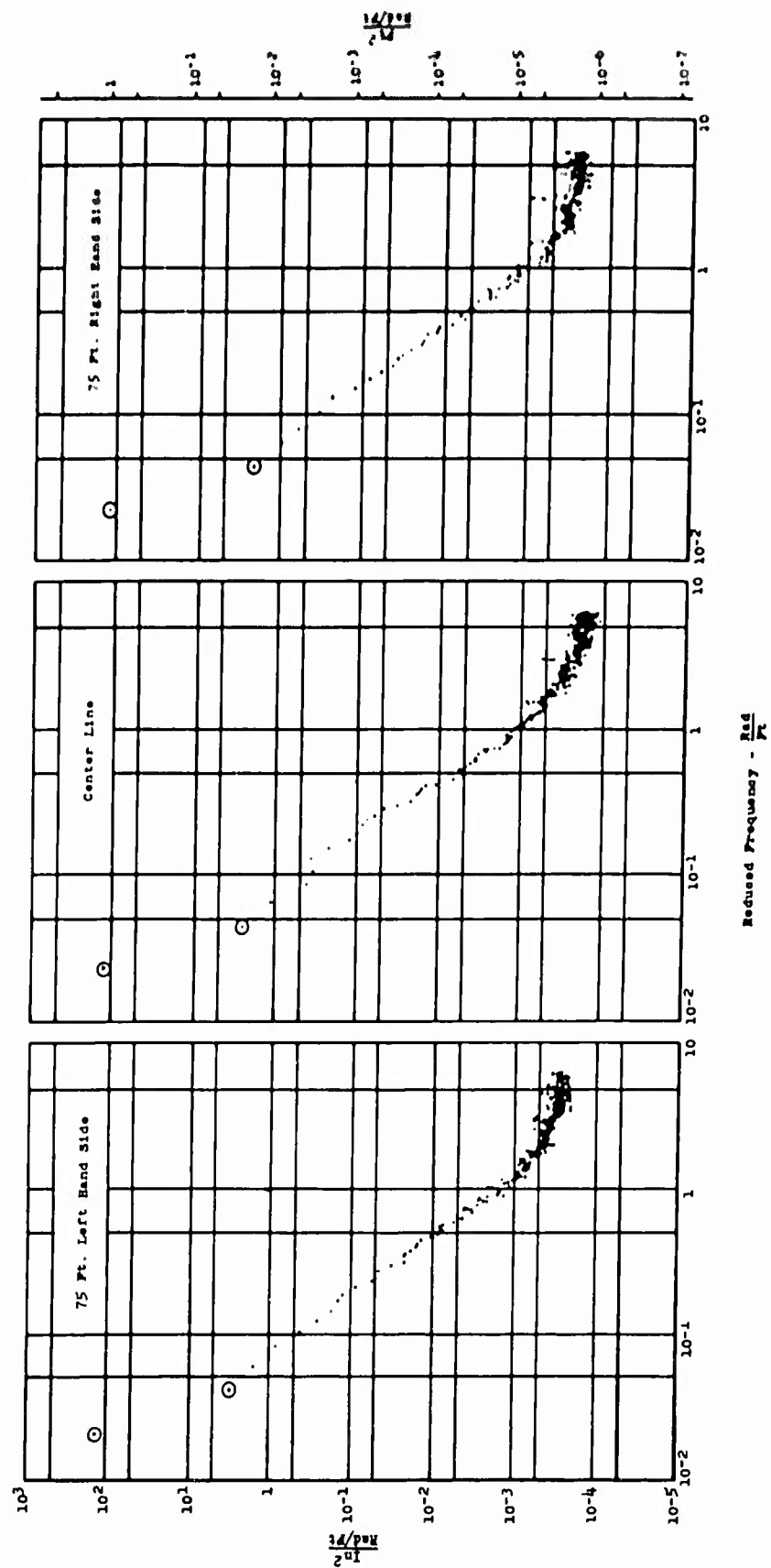


Figure 59 - Power Spectral Density, Runway 18, Sewart Air Force Base

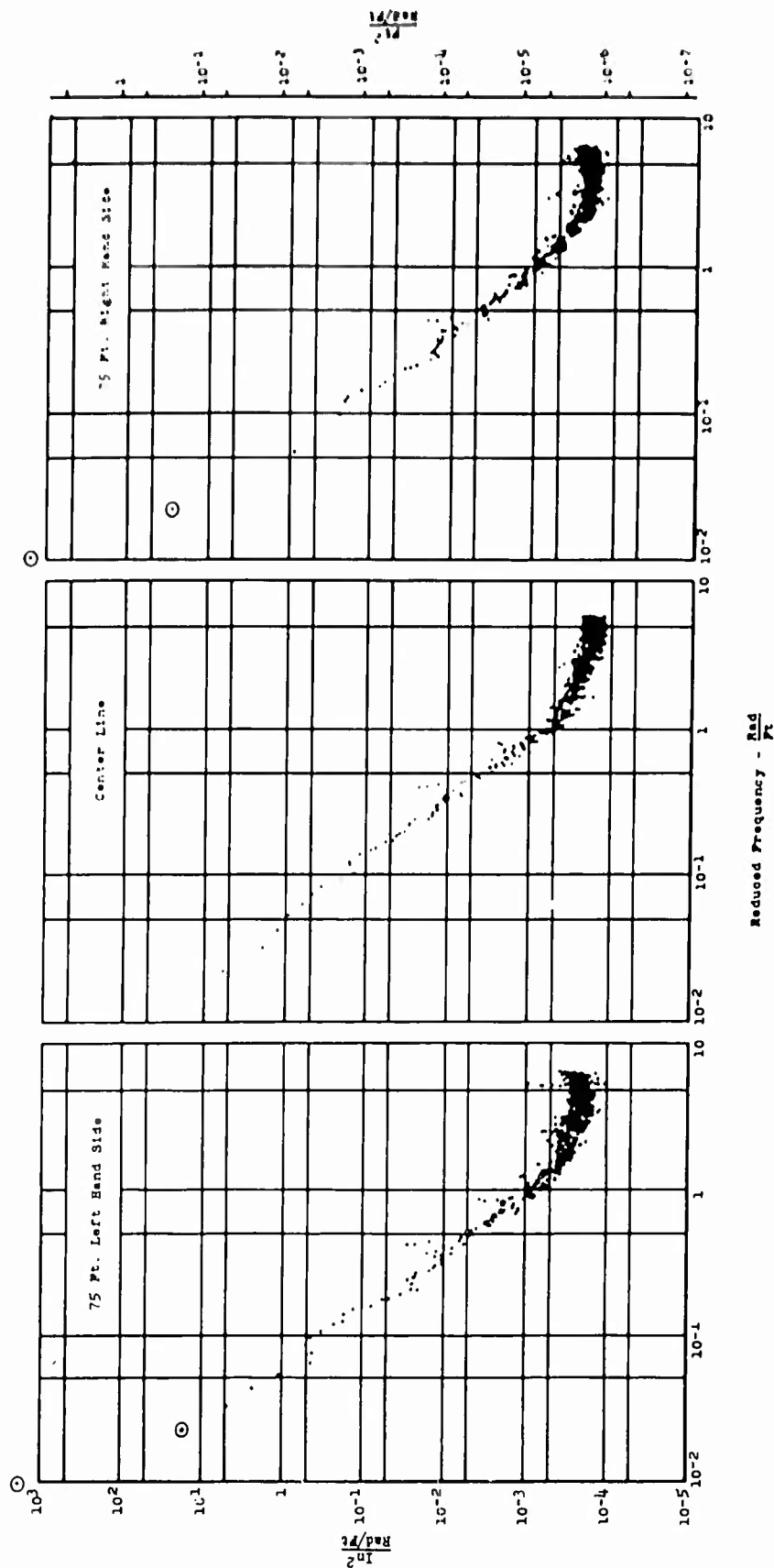


Figure 60 - Power Spectral Density, Runway 14, Sewart Air Force Base

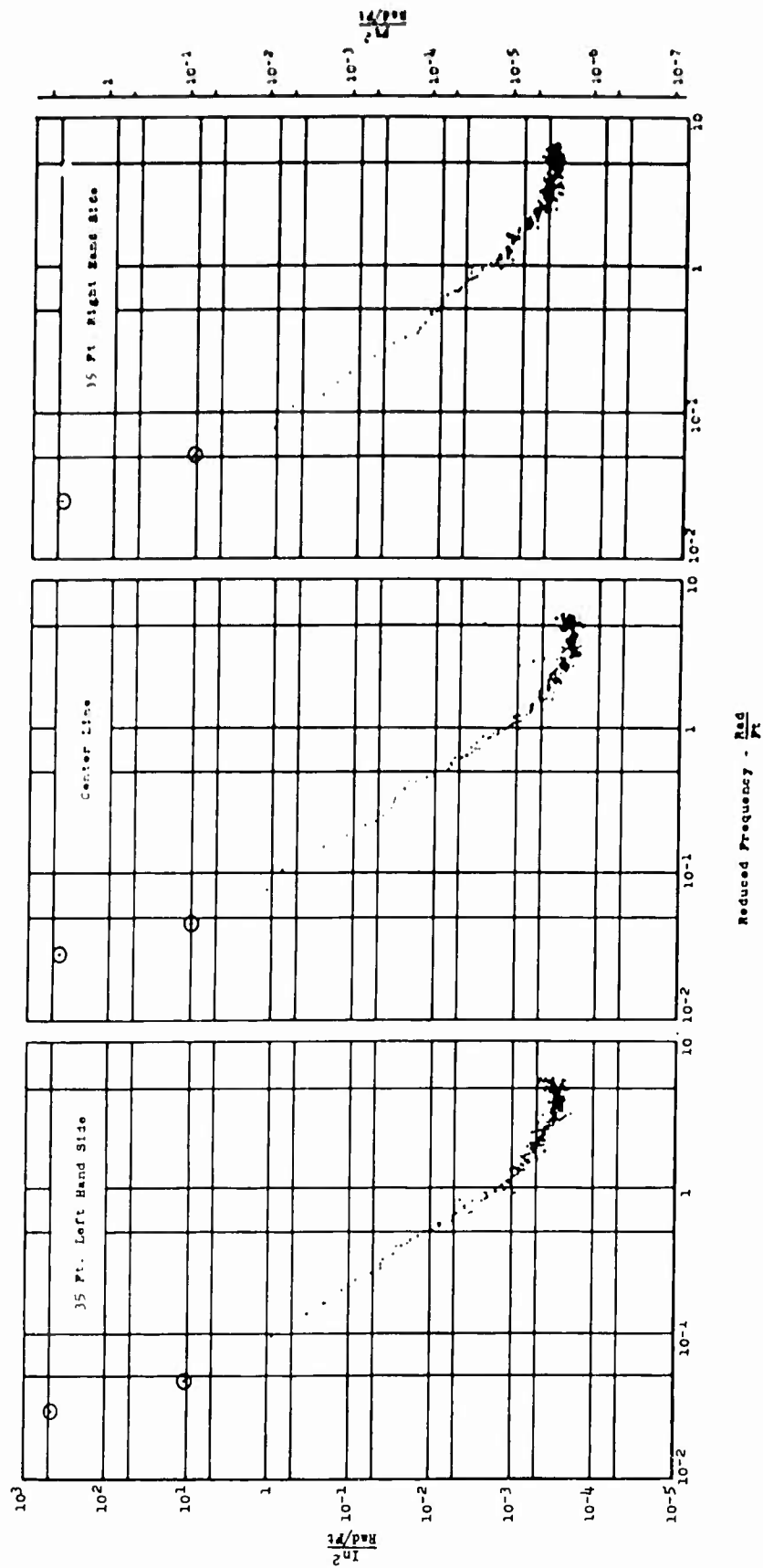


Figure 61 - Power Spectral Density, Taxiway 2, Sewart Air Force Base

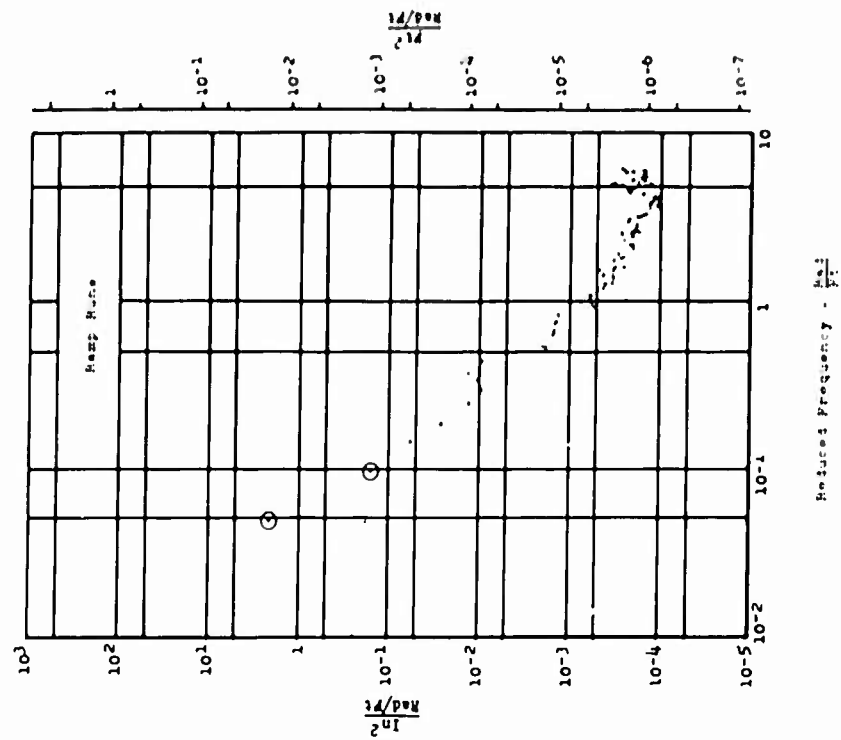


Figure 62 - Power Spectral Density, Sewart Air Force Base

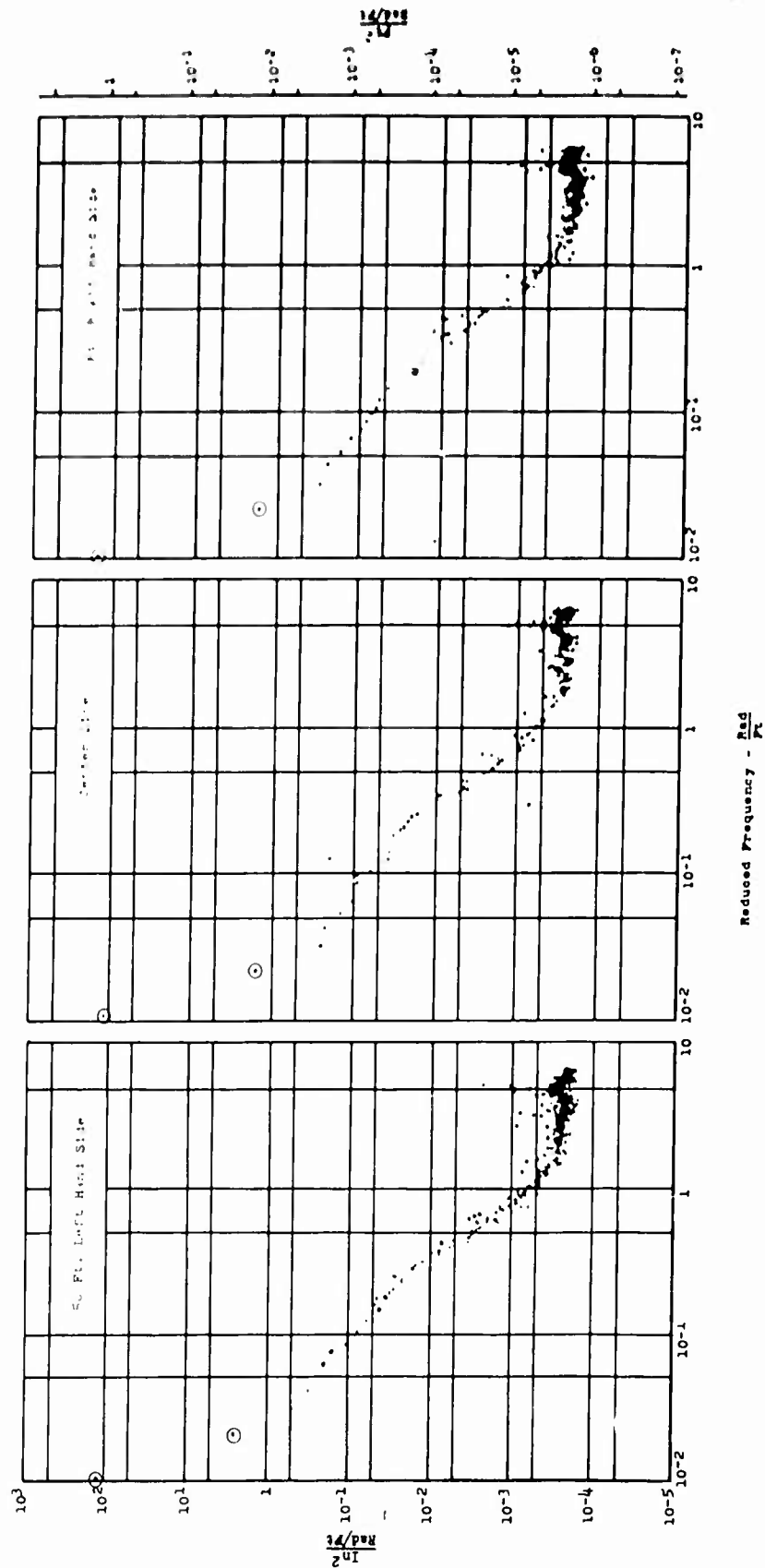


Figure 63 - Power Spectral Density, Runway 4, Shaw Air Force Base

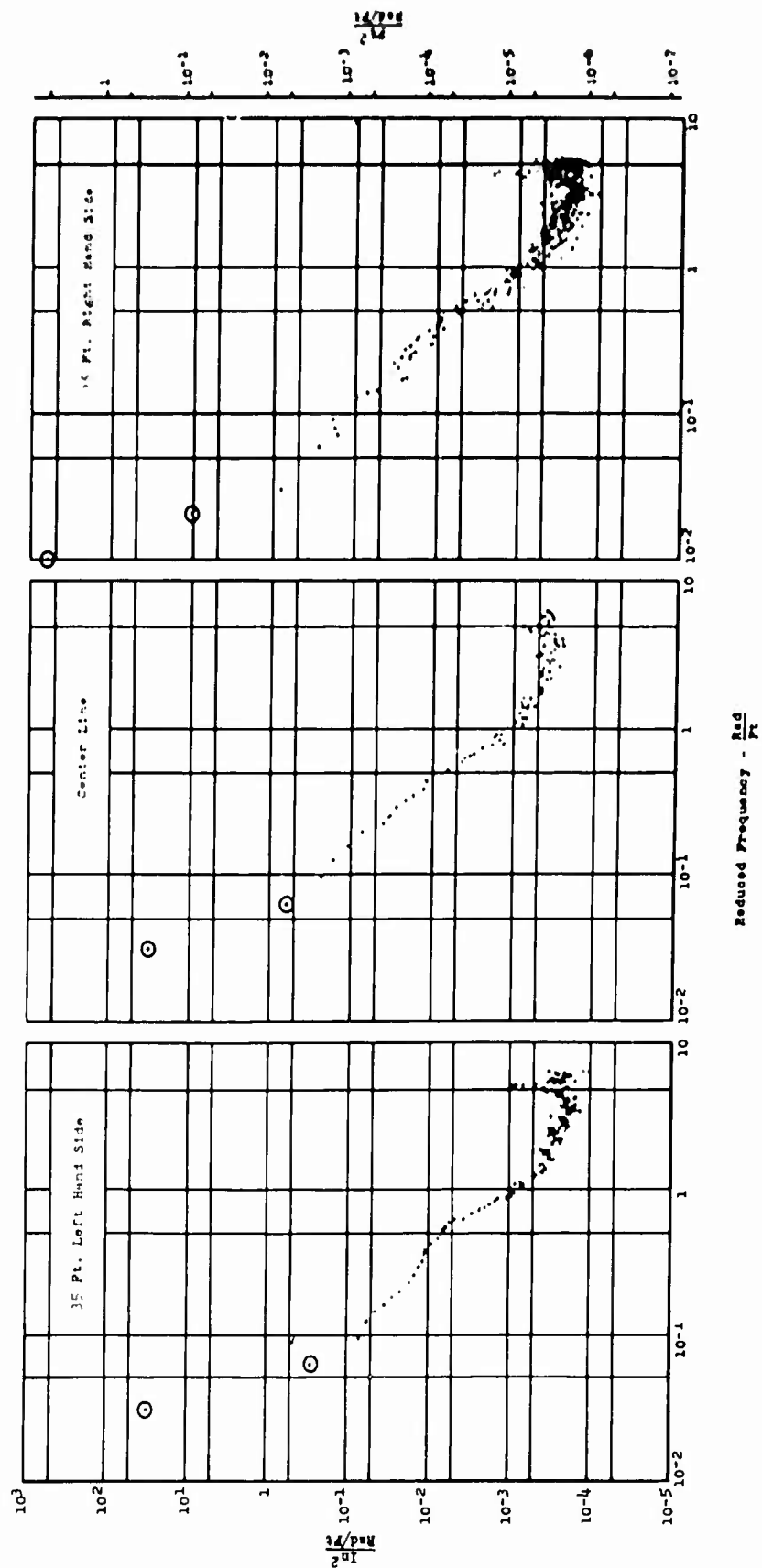


Figure 64 - Power Spectral Density, Taxiway, Shaw Air Force Base

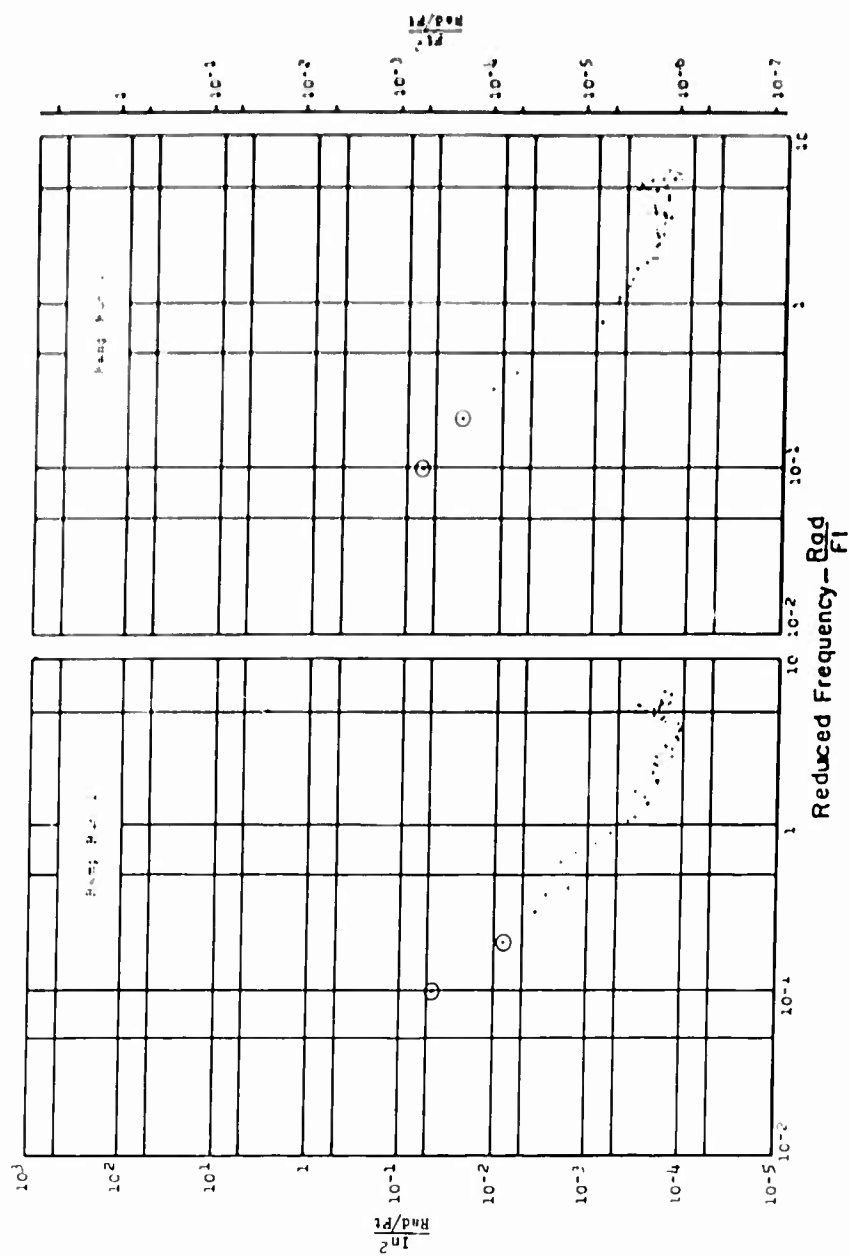


Figure 65 - Power Spectral Density, Shaw Air Force Base

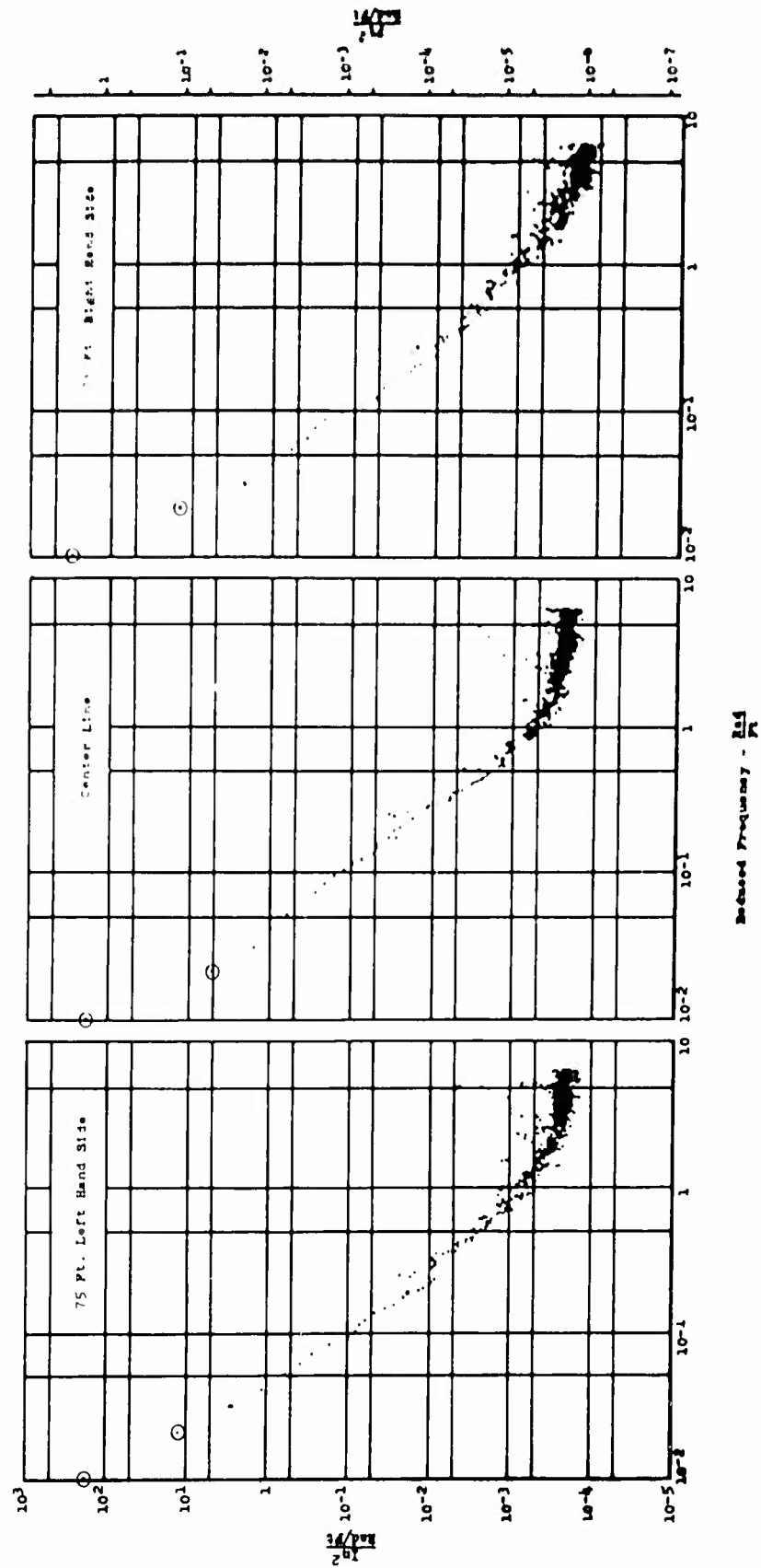


Figure 66 - Power Spectral Density, Runway 21, Travis Air Force Base

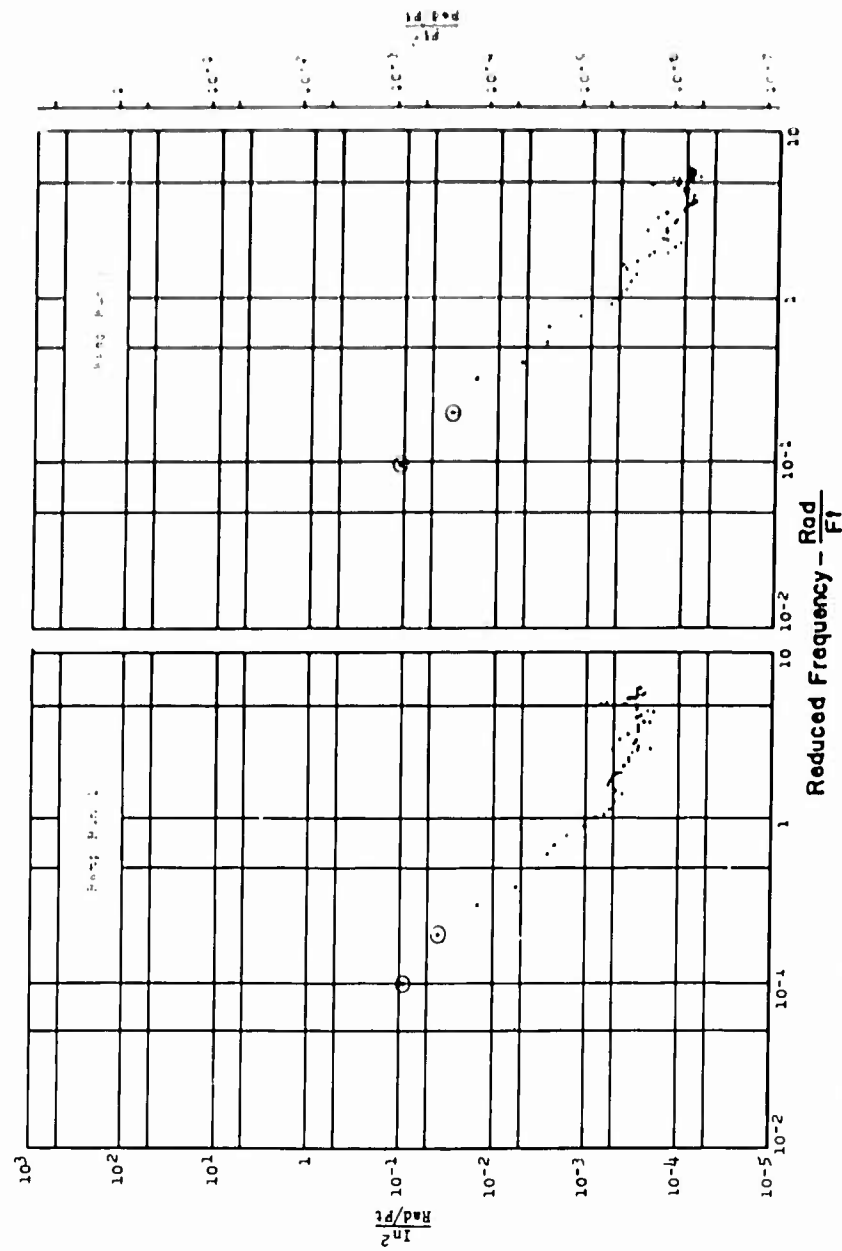


Figure 67 - Power Spectral Density, Travis Air Force Base

APPENDIX II

PROFILE PLOTS

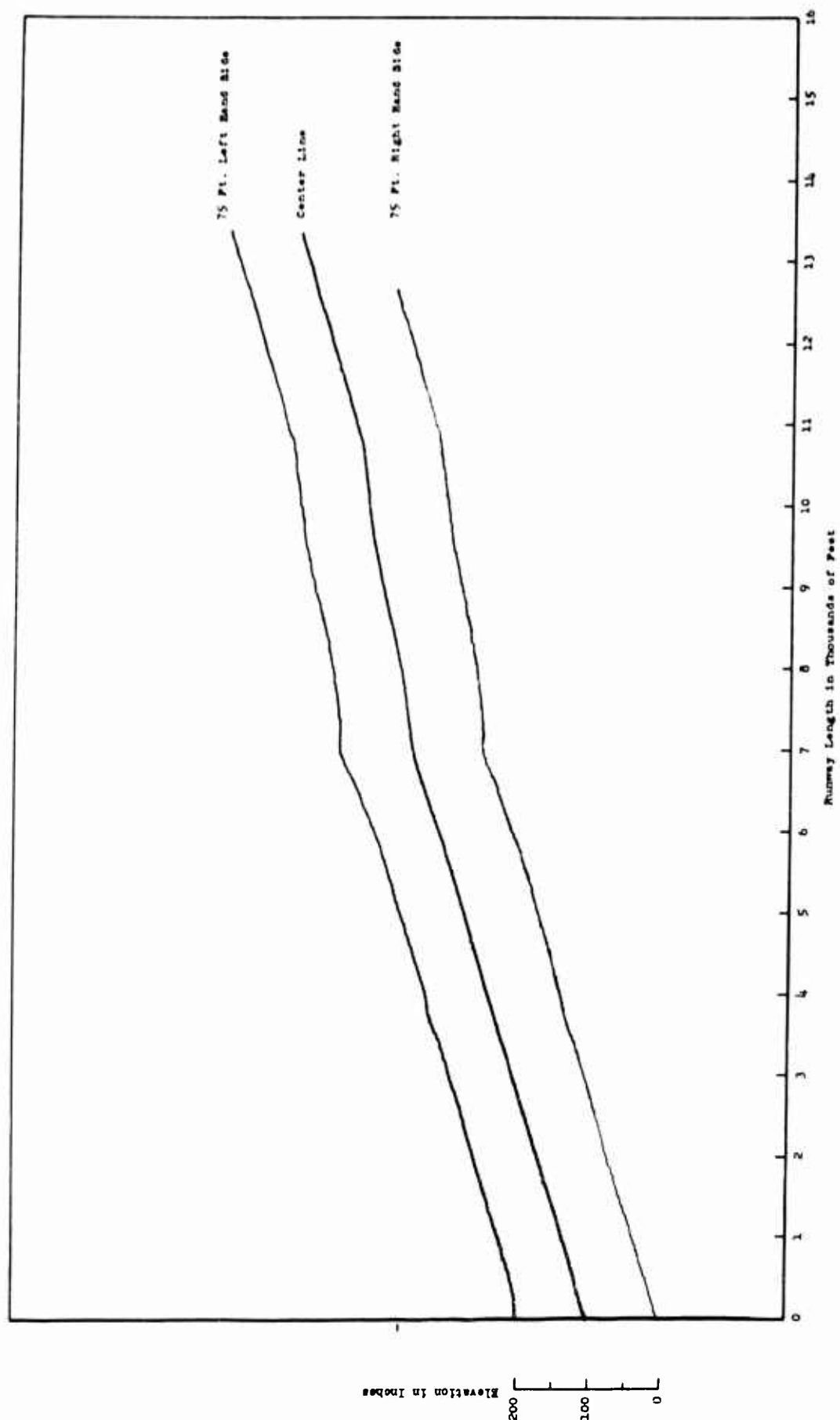


Figure 68 - Profiles, Runway 35, Altus Air Force Base

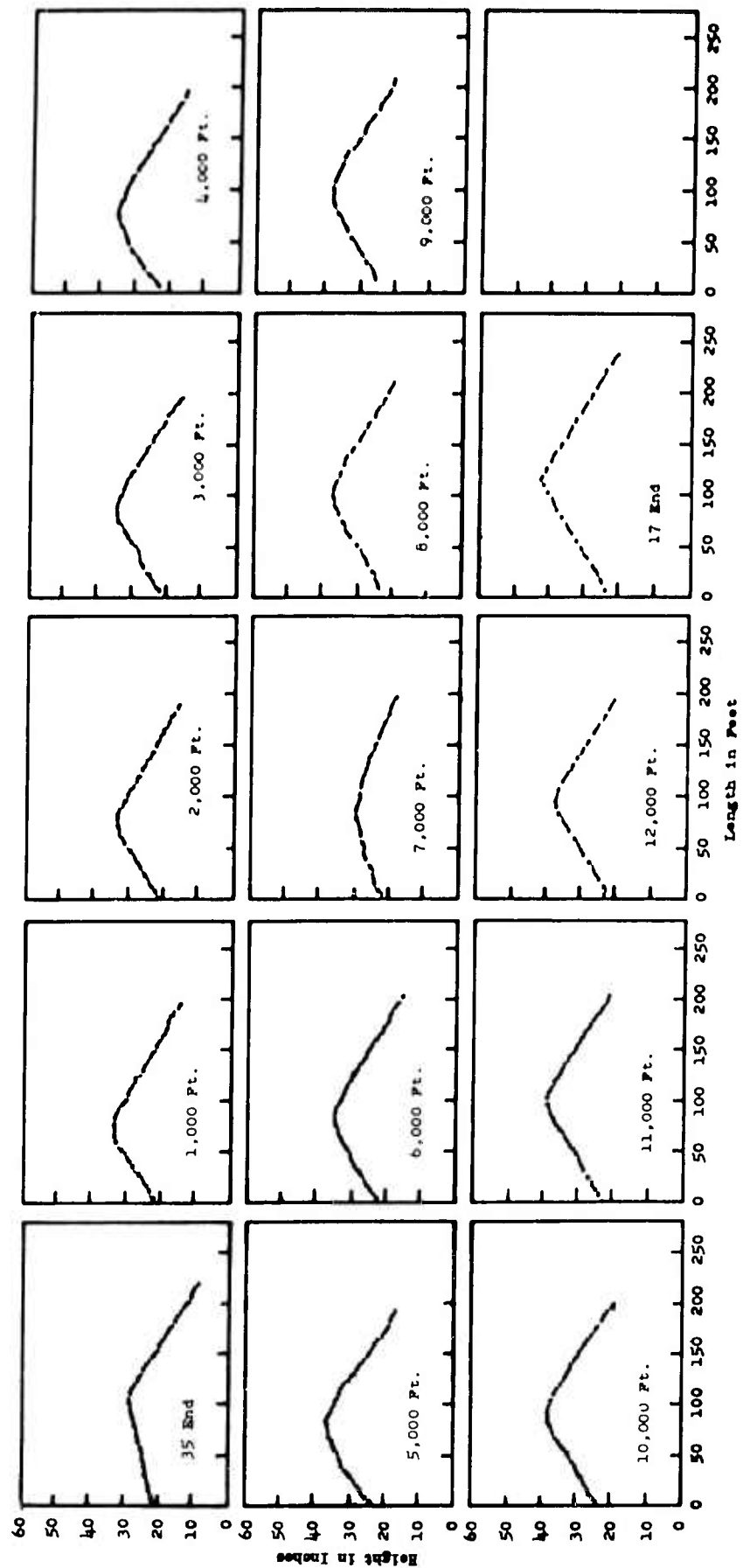


Figure 69 - Cross Run Profiles, Runway 35, Altus Air Force Base

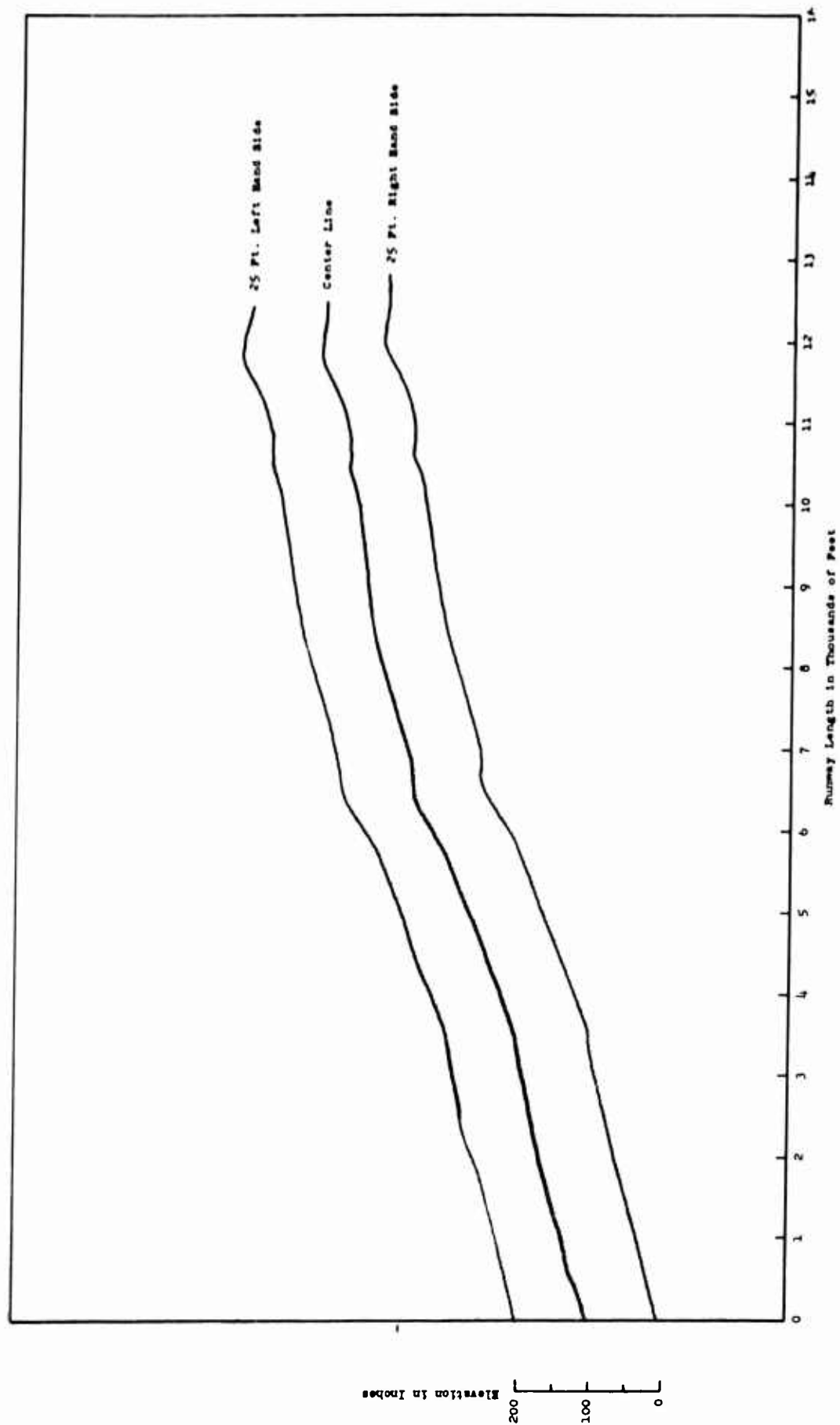


Figure 70 - Profiles, Taxiway 5, Altus Air Force Base

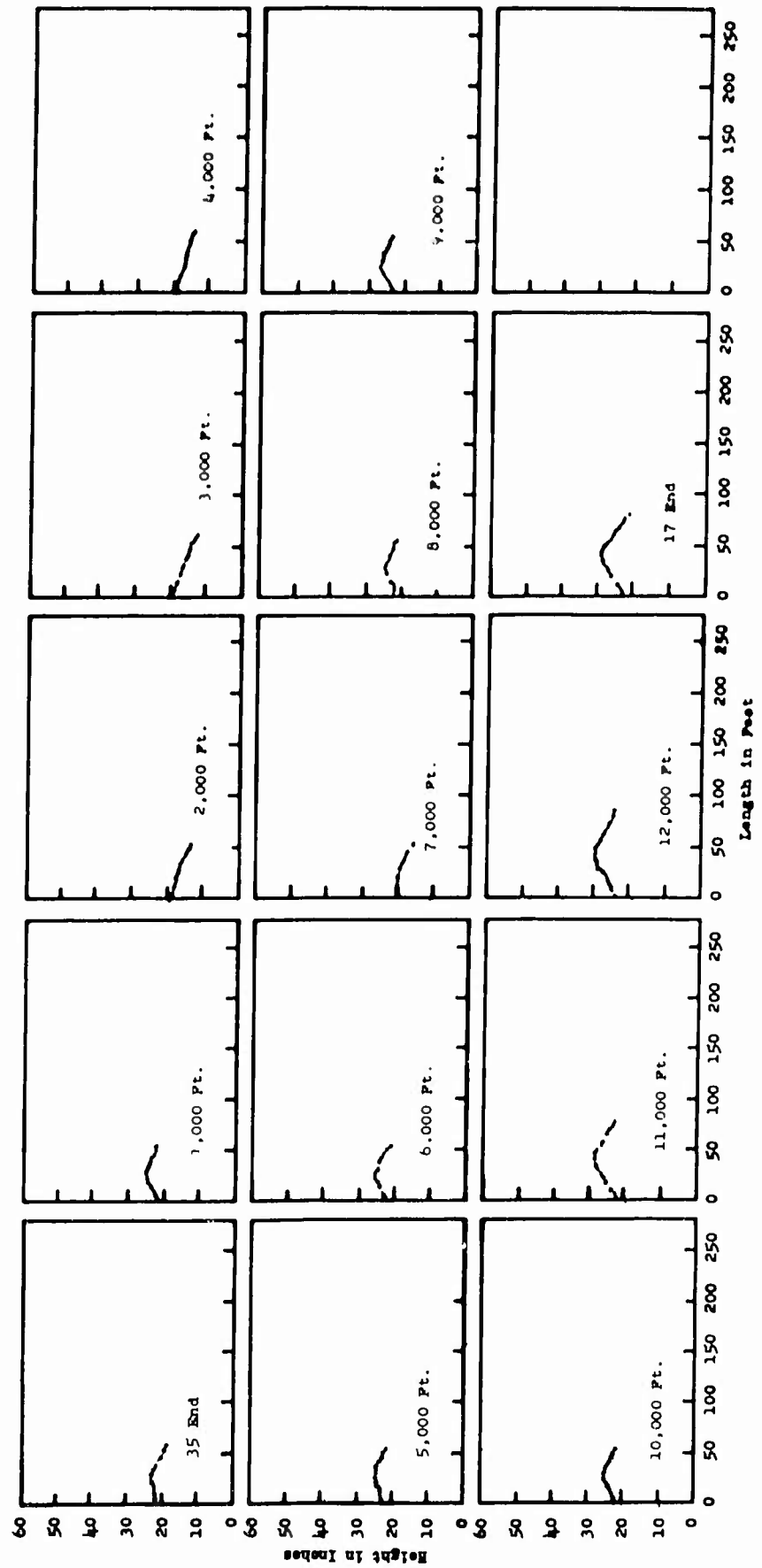


Figure 71 - Cross Run Profiles, Taxiway 5, Altus Air Force Base

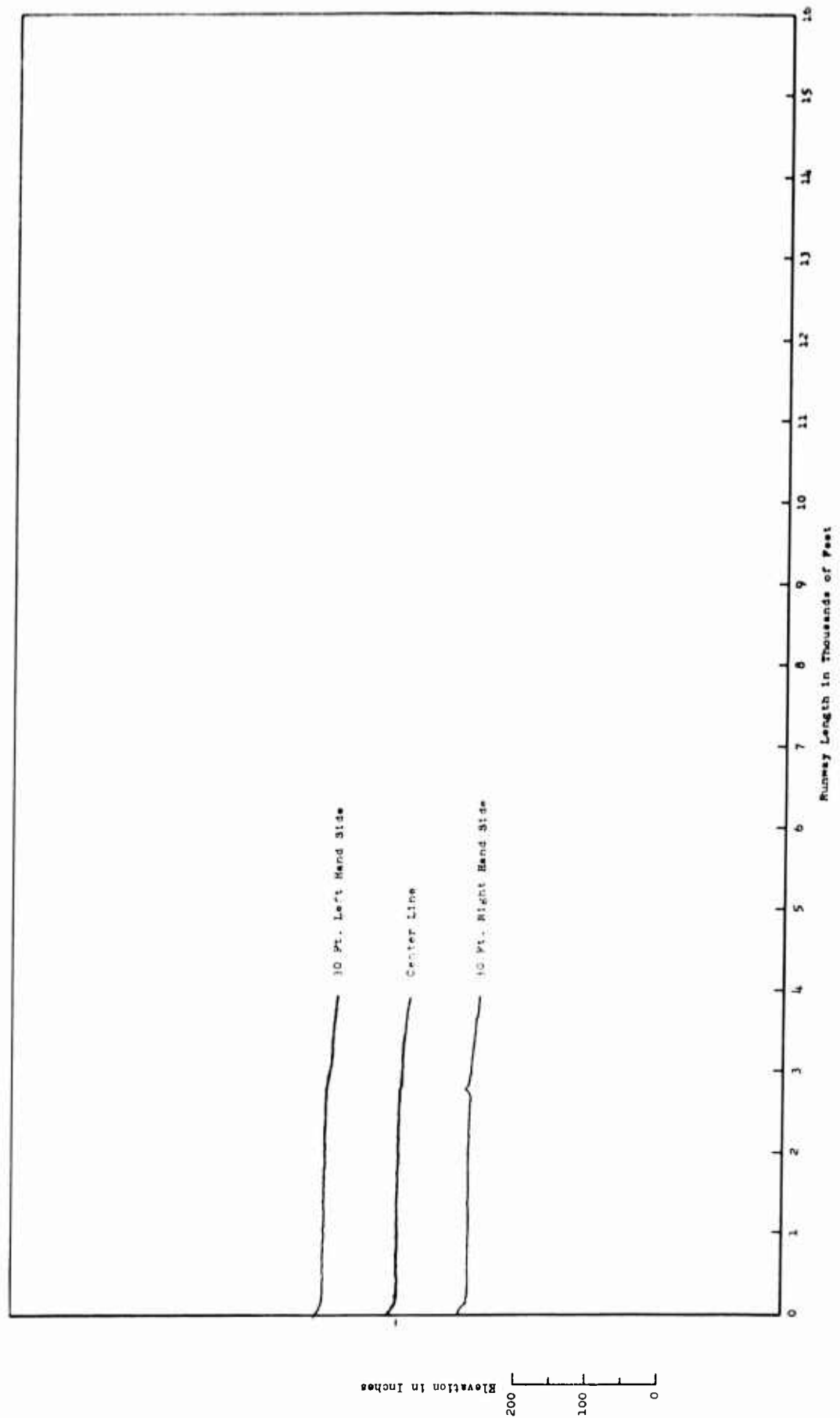


Figure 72 - Profiles, Taxiway 27, Bakalar Air Force Base

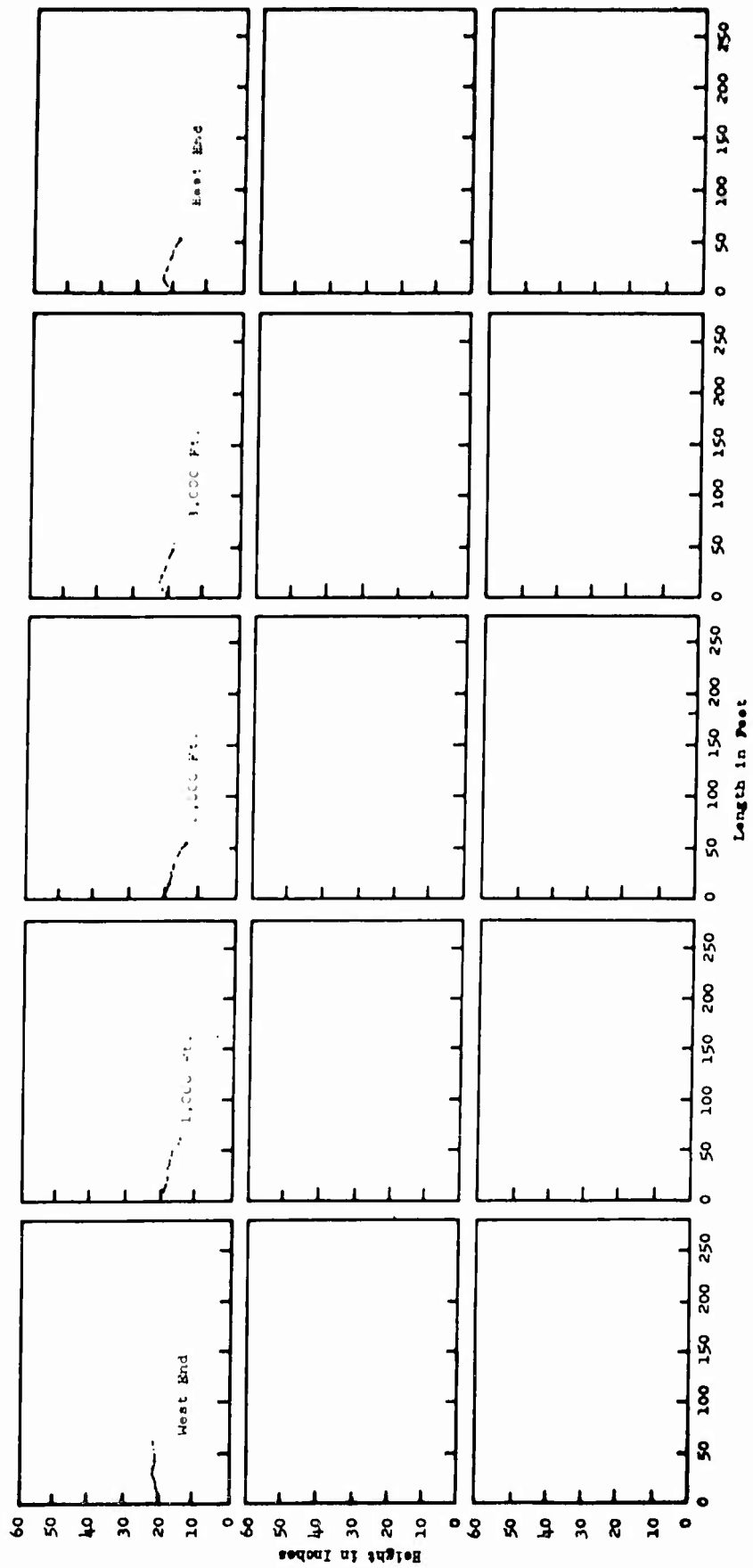


Figure 73 - Cross Run Profiles, Taxiway 27, Babalar Air Force Base

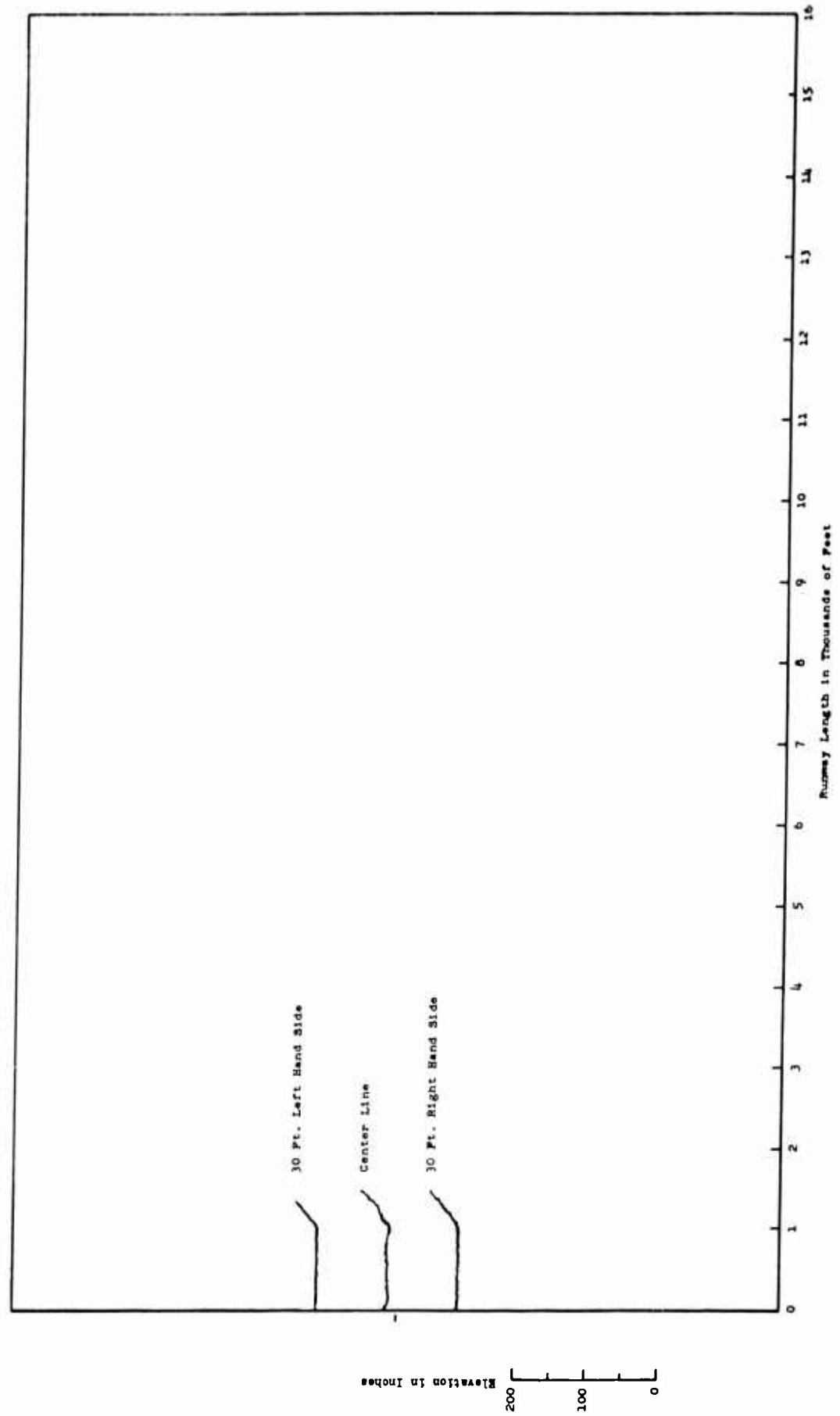


Figure 74 - Profiles, Taxiway 3, Bakalar Air Force Base

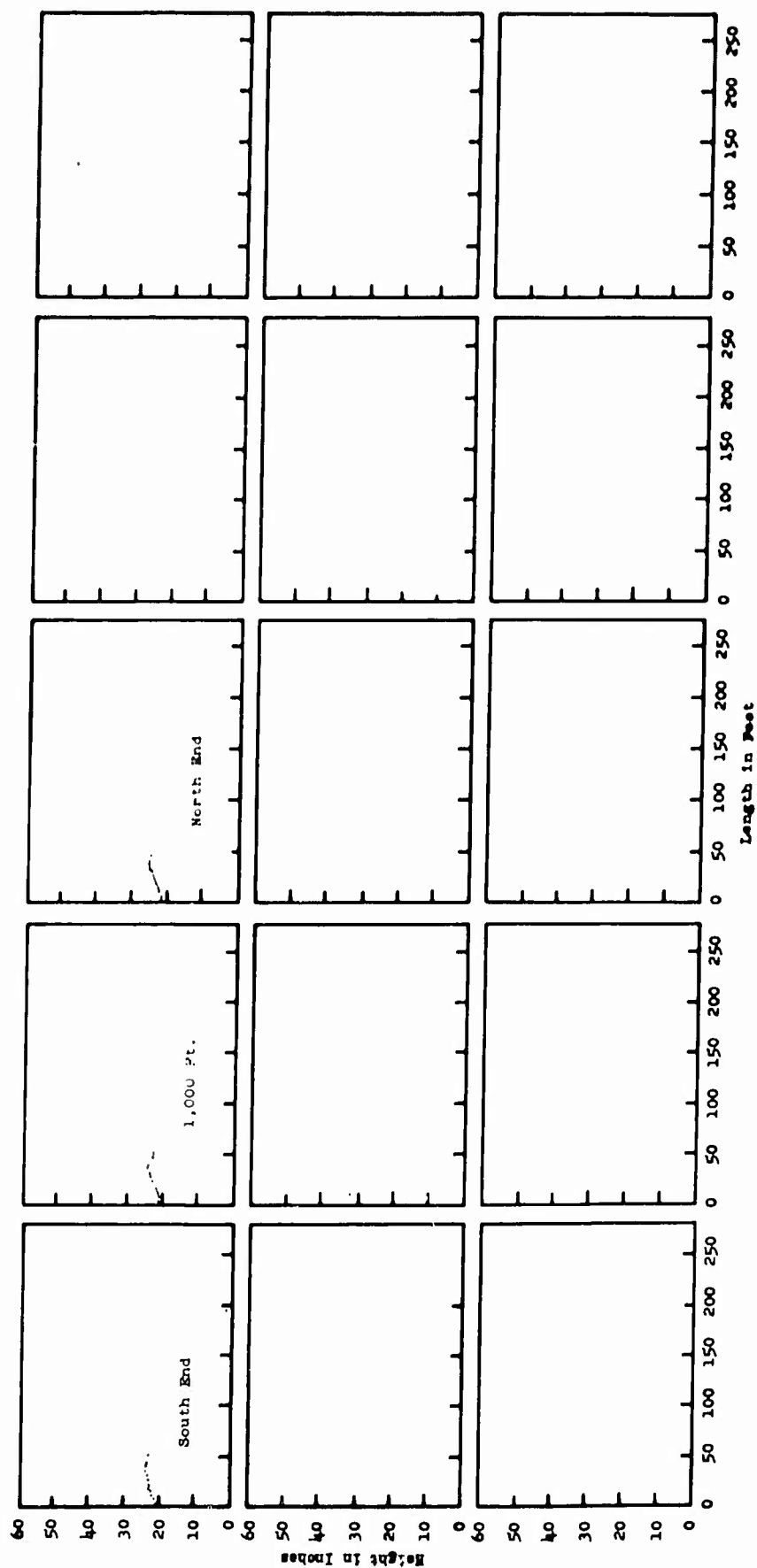


Figure 75 - Cross Run Profiles, Taxiway 3, Bakalar Air Force Base

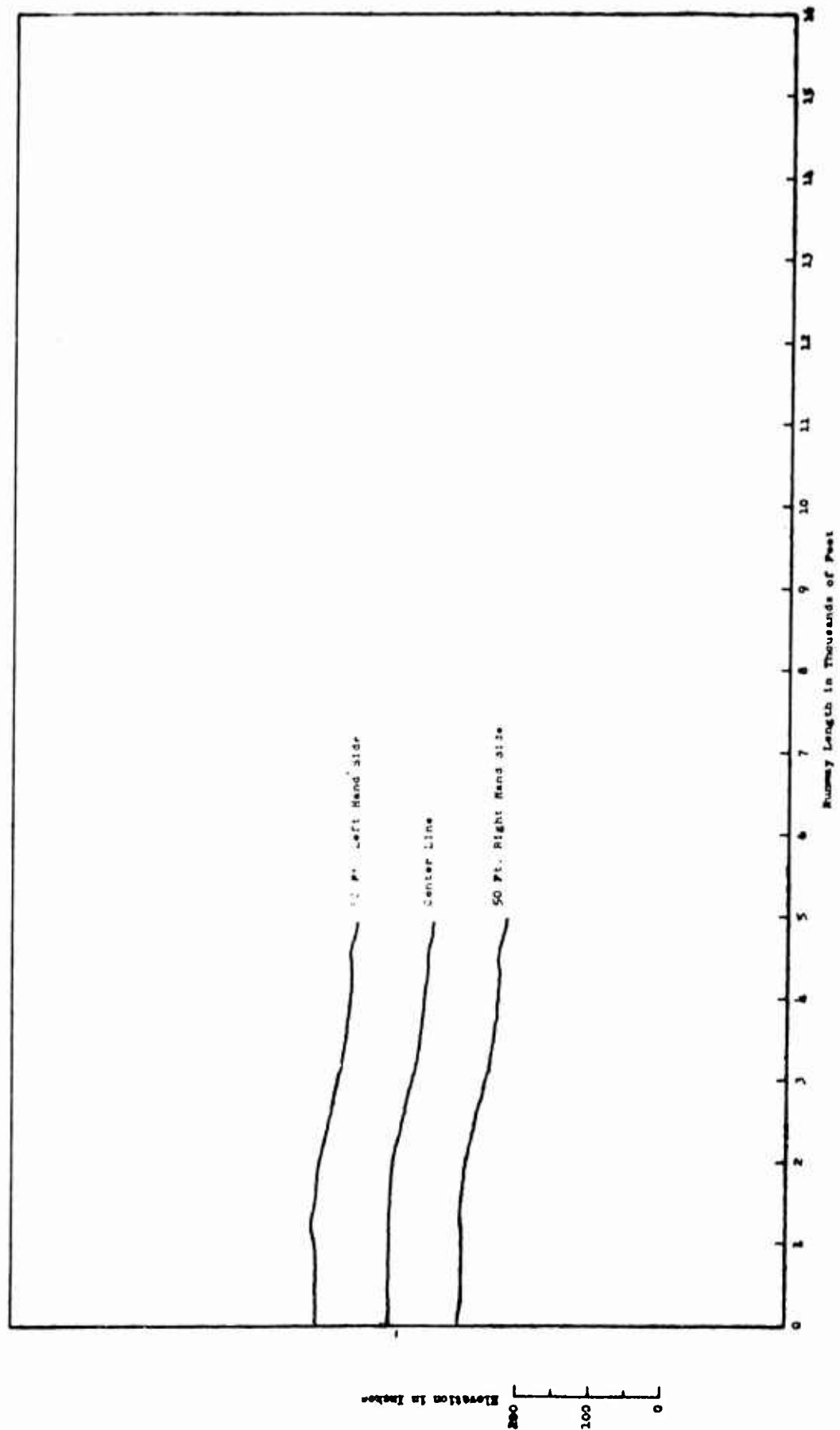


Figure 76 - Profiles, Runway 18, Bakalar Air Force Base

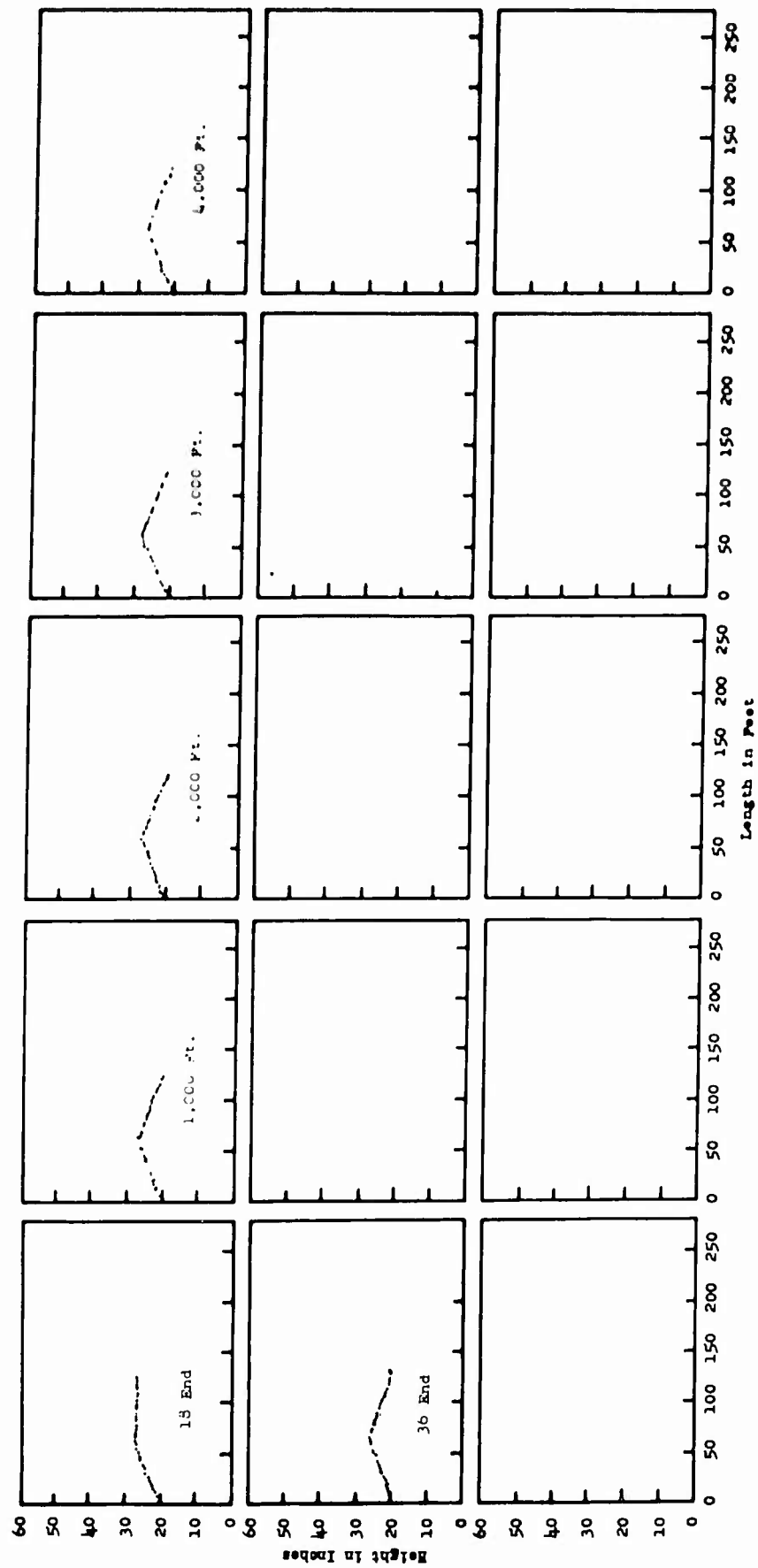


Figure 77 - Cross Run Profiles, Runway 18, Bakalar Air Force Base

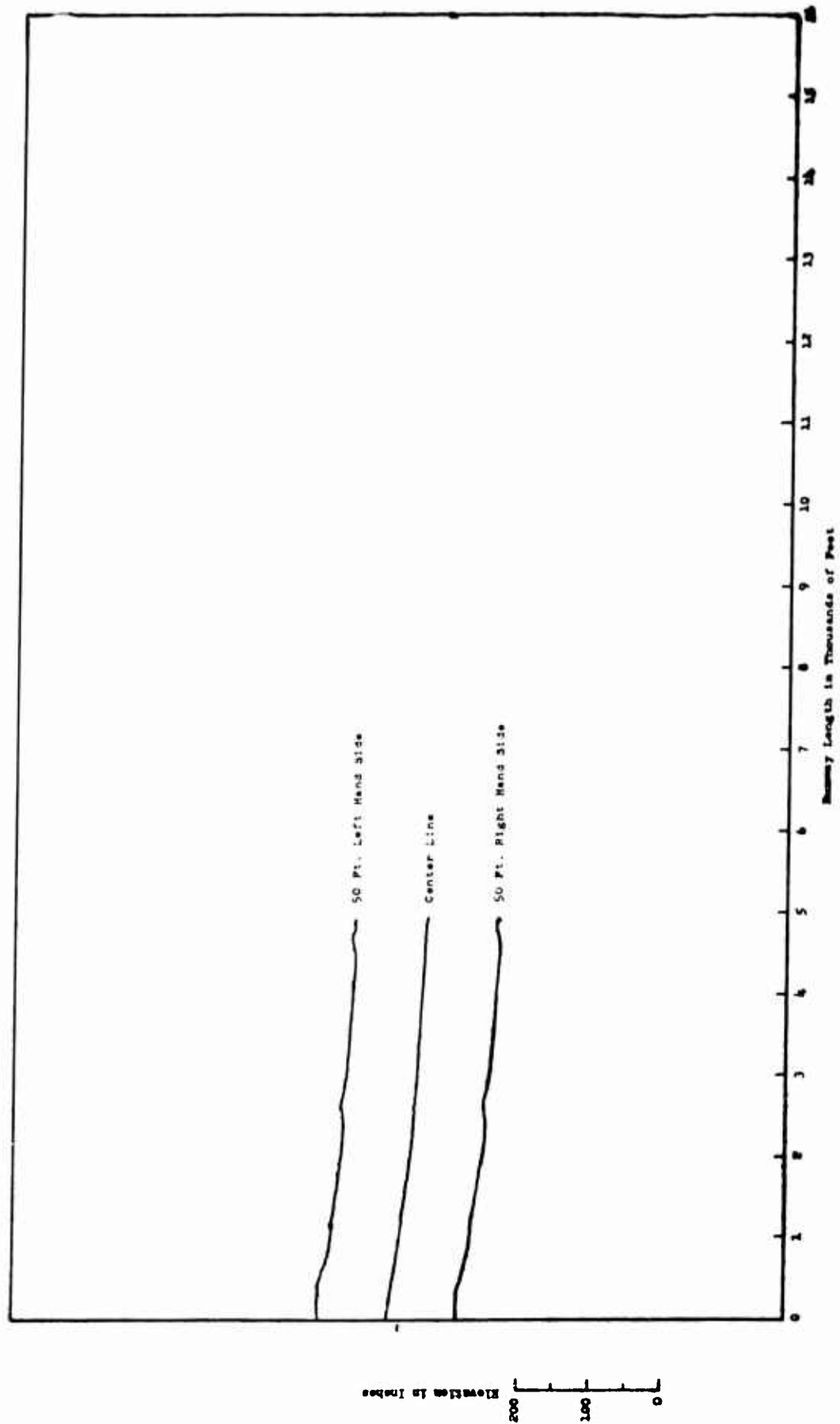


Figure 78 - Profiles, Runway 22, Babalar Air Force Base

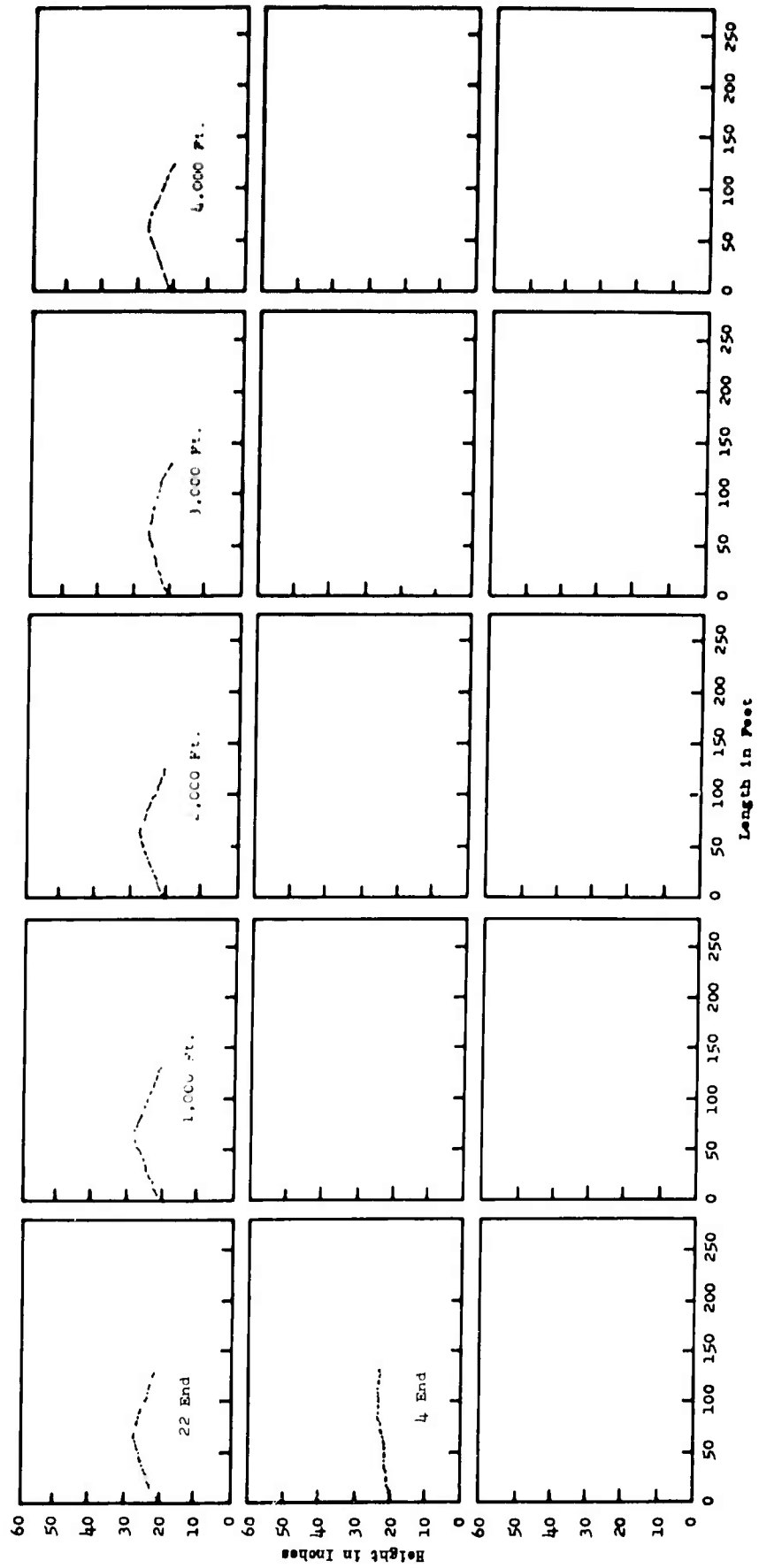


Figure 79 - Cross Run Profiles, Runway 22, Bakalar Air Force Base

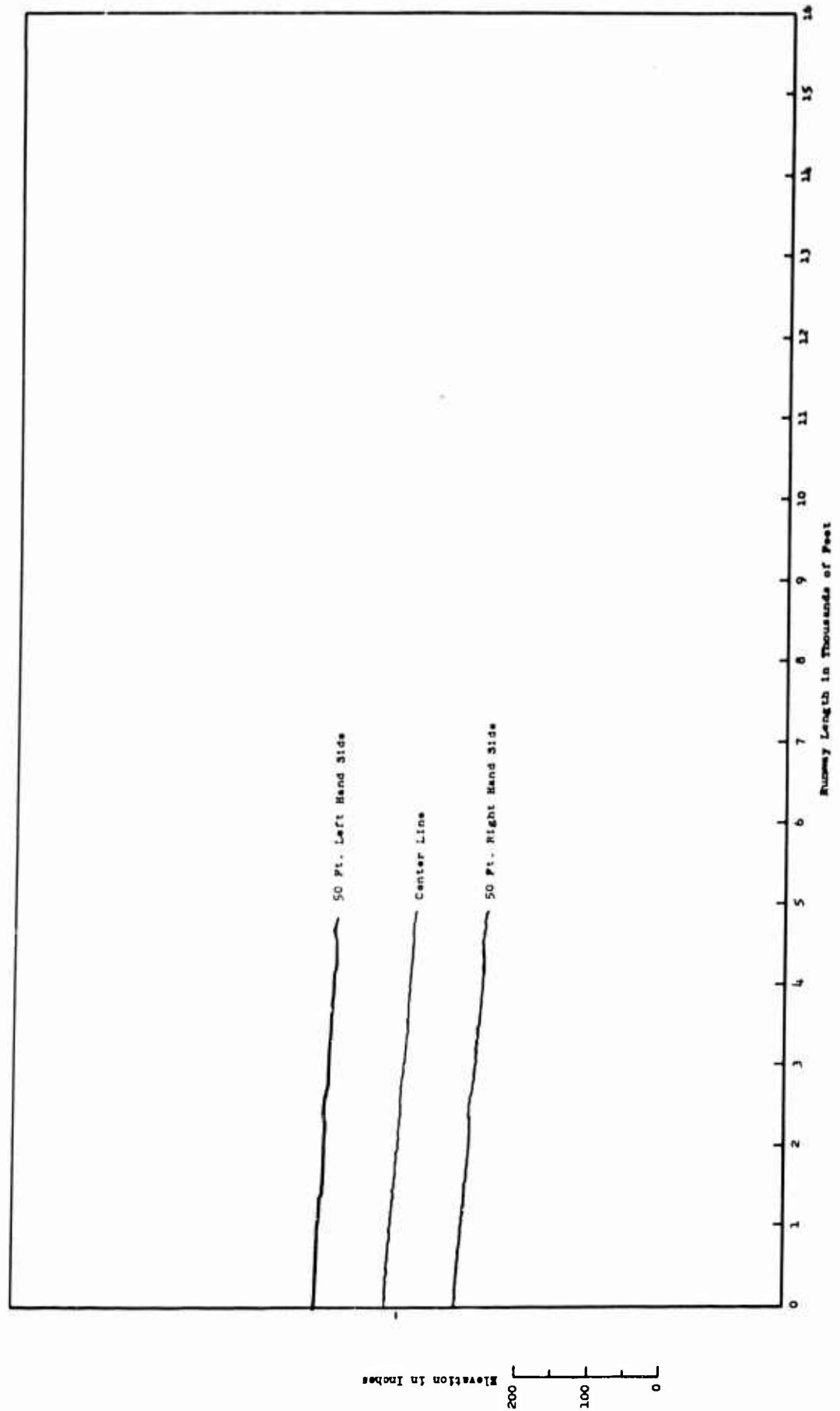


Figure 80 - Profiles, Runway 13, Bakalar Air Force Base

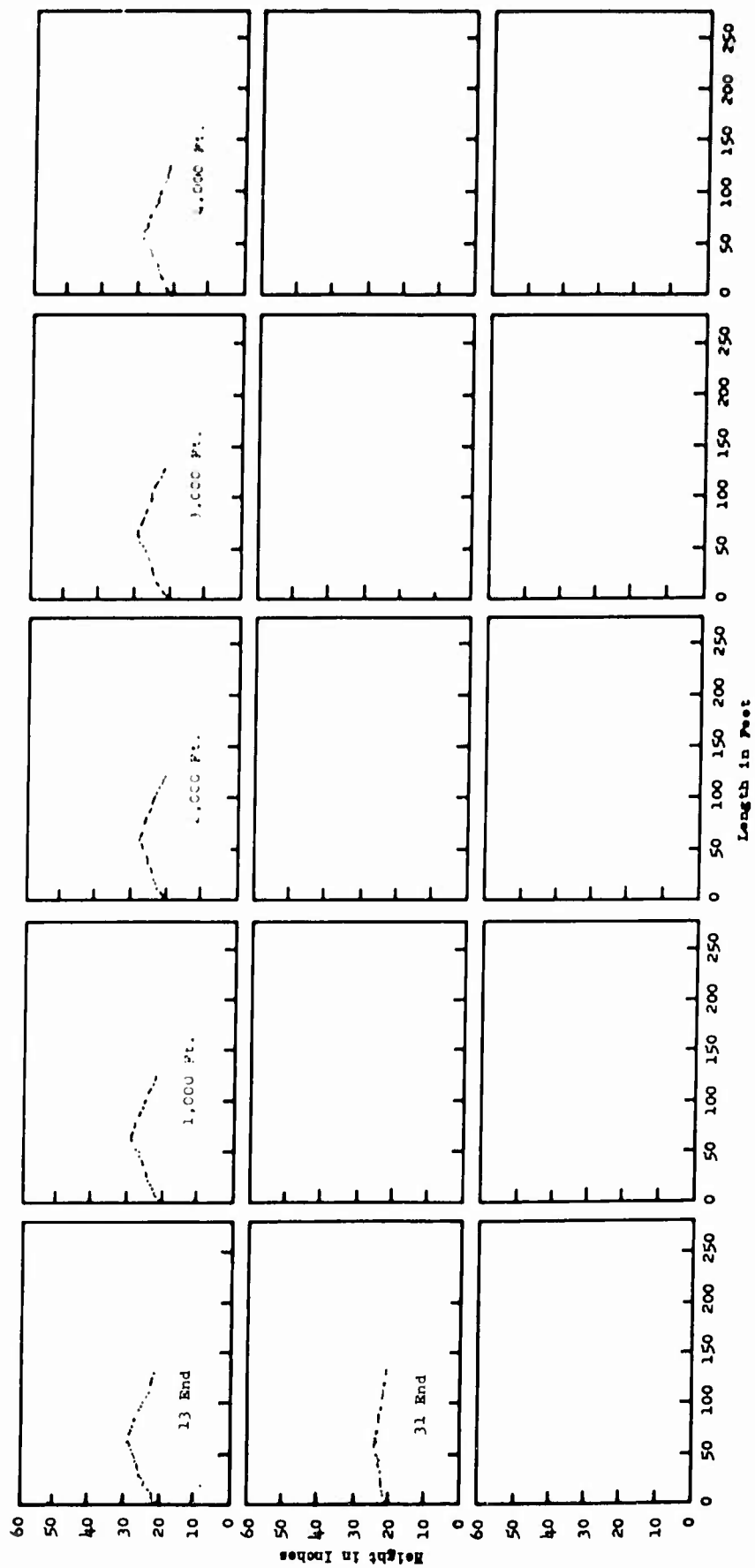


Figure 81 - Cross Run Profiles, Runway 13, Babalar Air Force Base

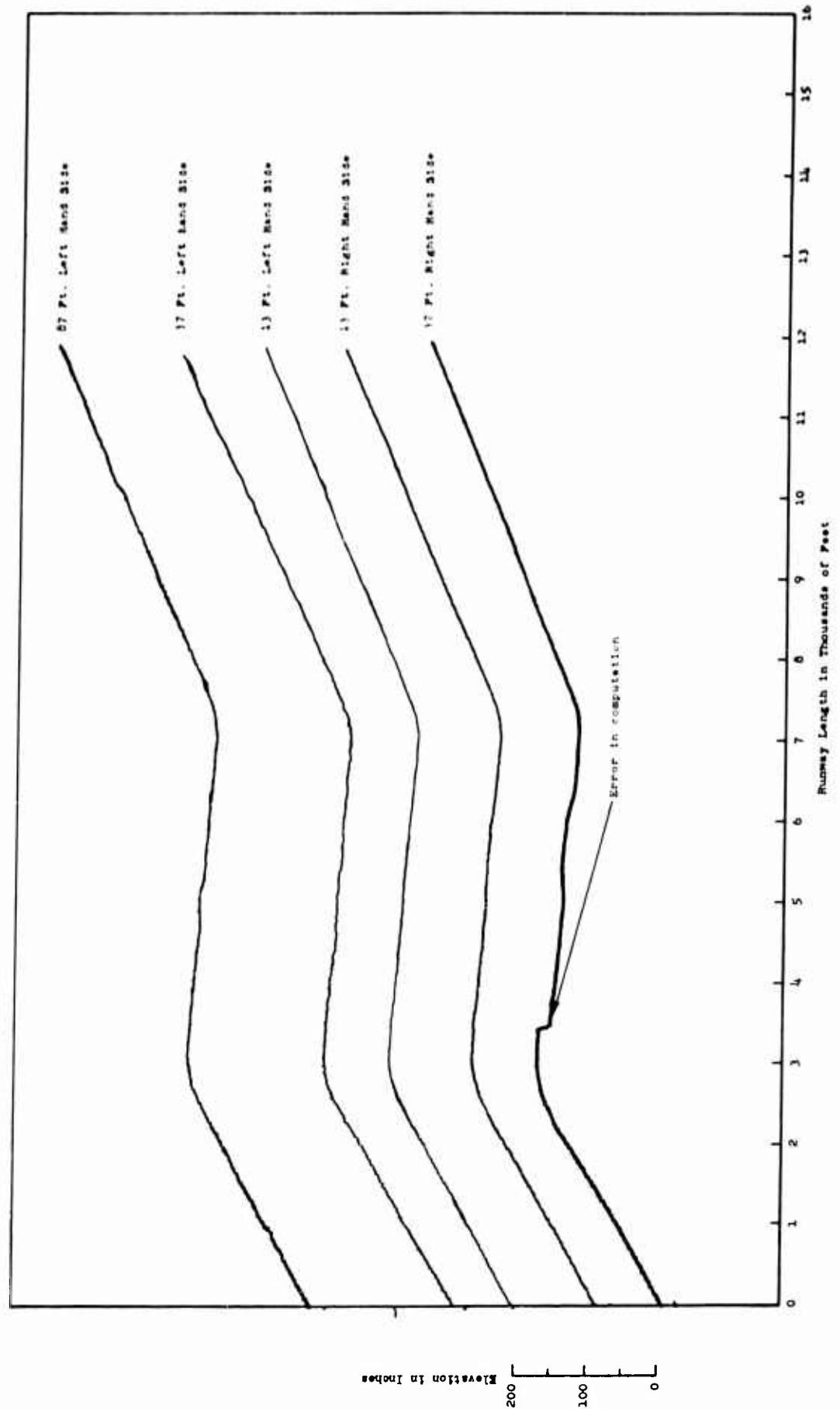


Figure 82 - Profiles, Runway 17, Carswell Air Force Base

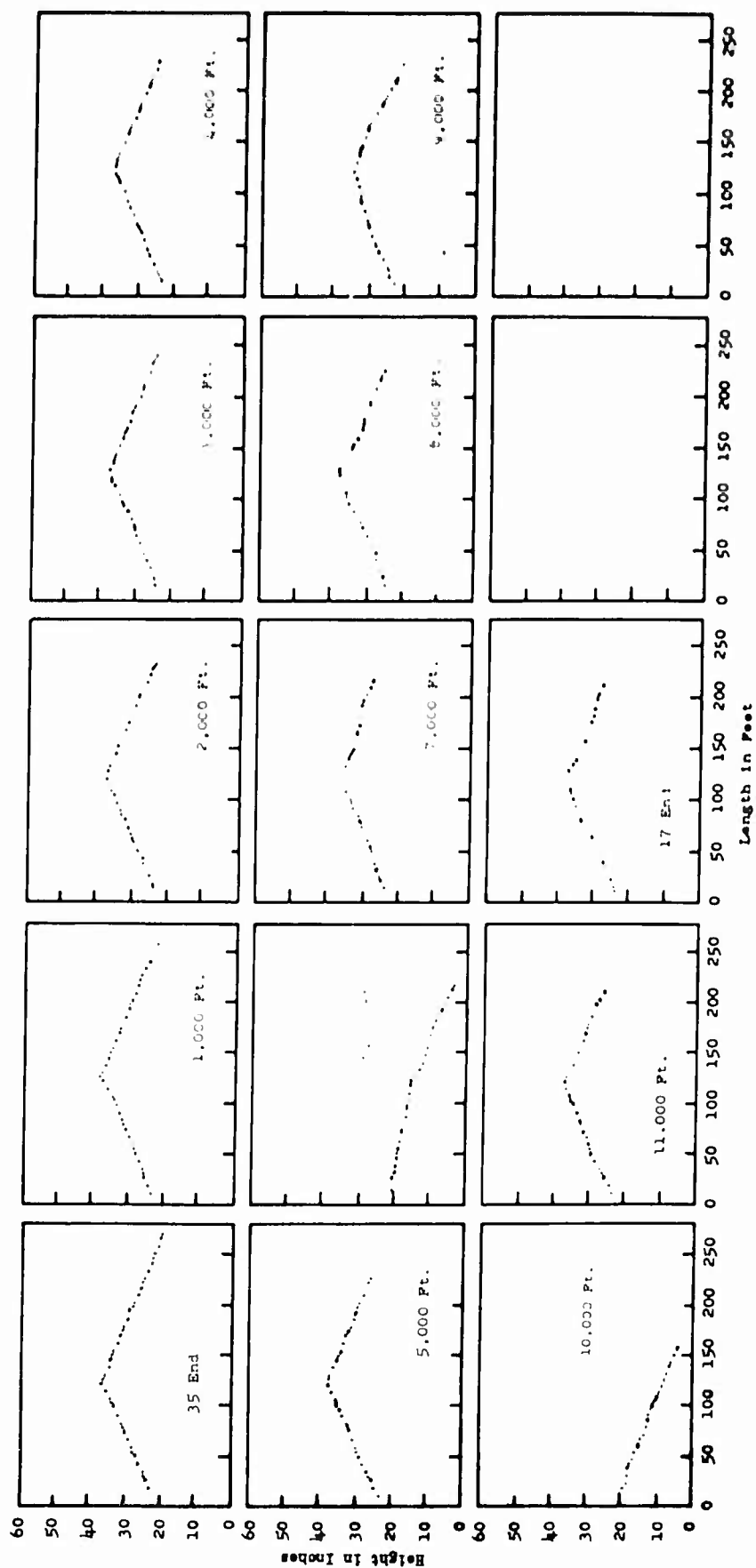


Figure 83 - Cross Run Profiles, Runway 17, Carswell Air Force Base

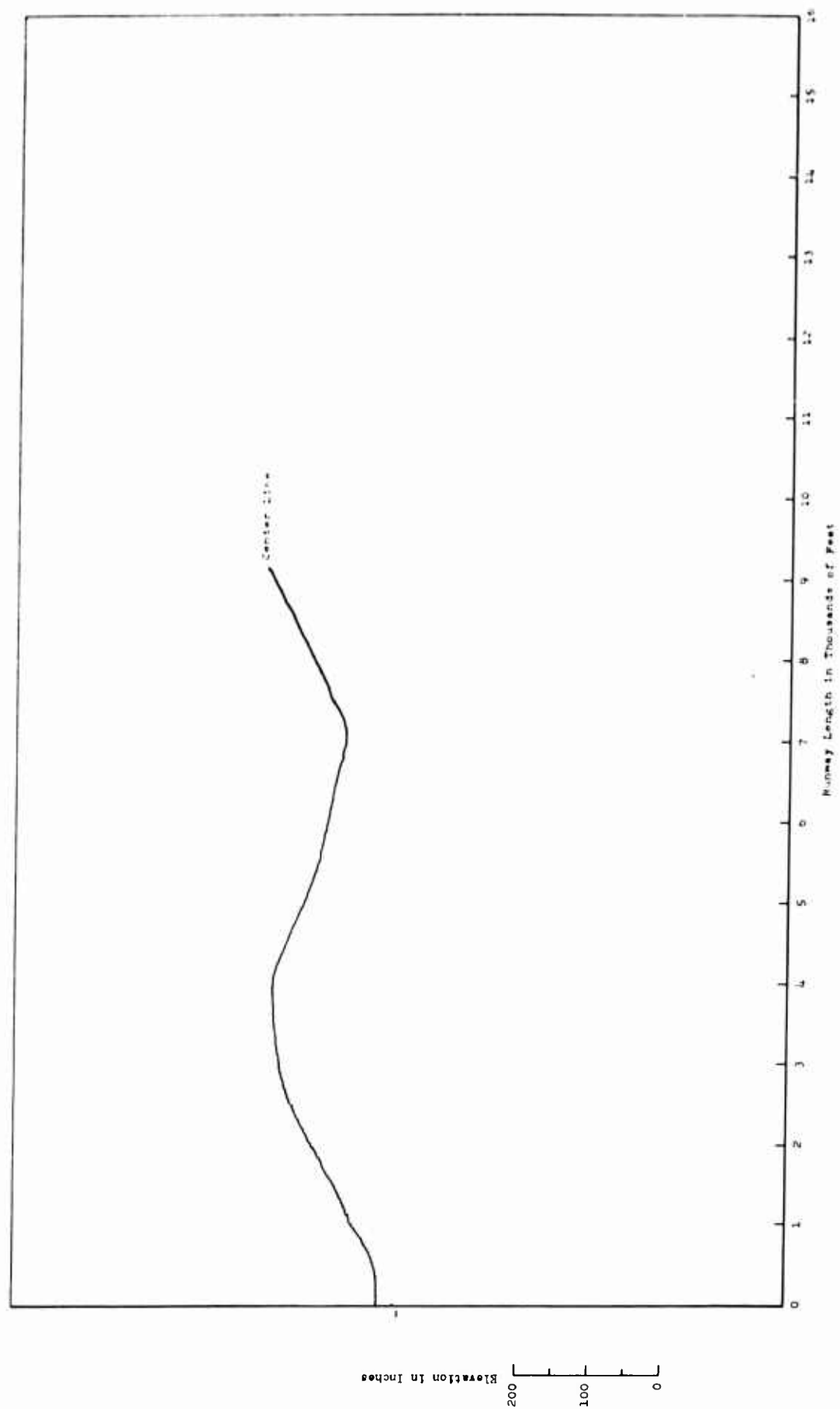


Figure 84 - Profile, Taxiway 17, Carswell Air Force Base

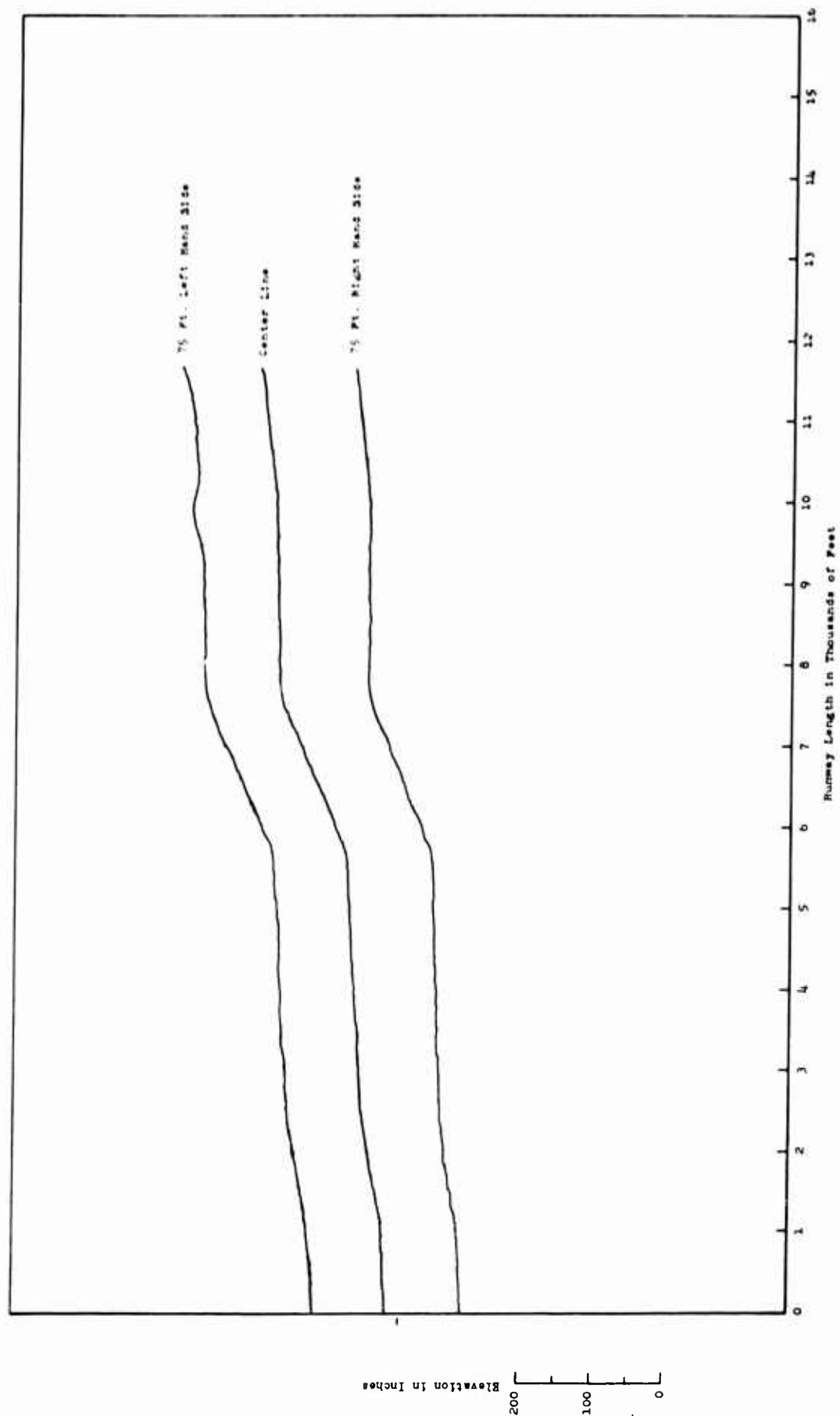


Figure 85 - Profiles, Runway 30, Castle Air Force Base

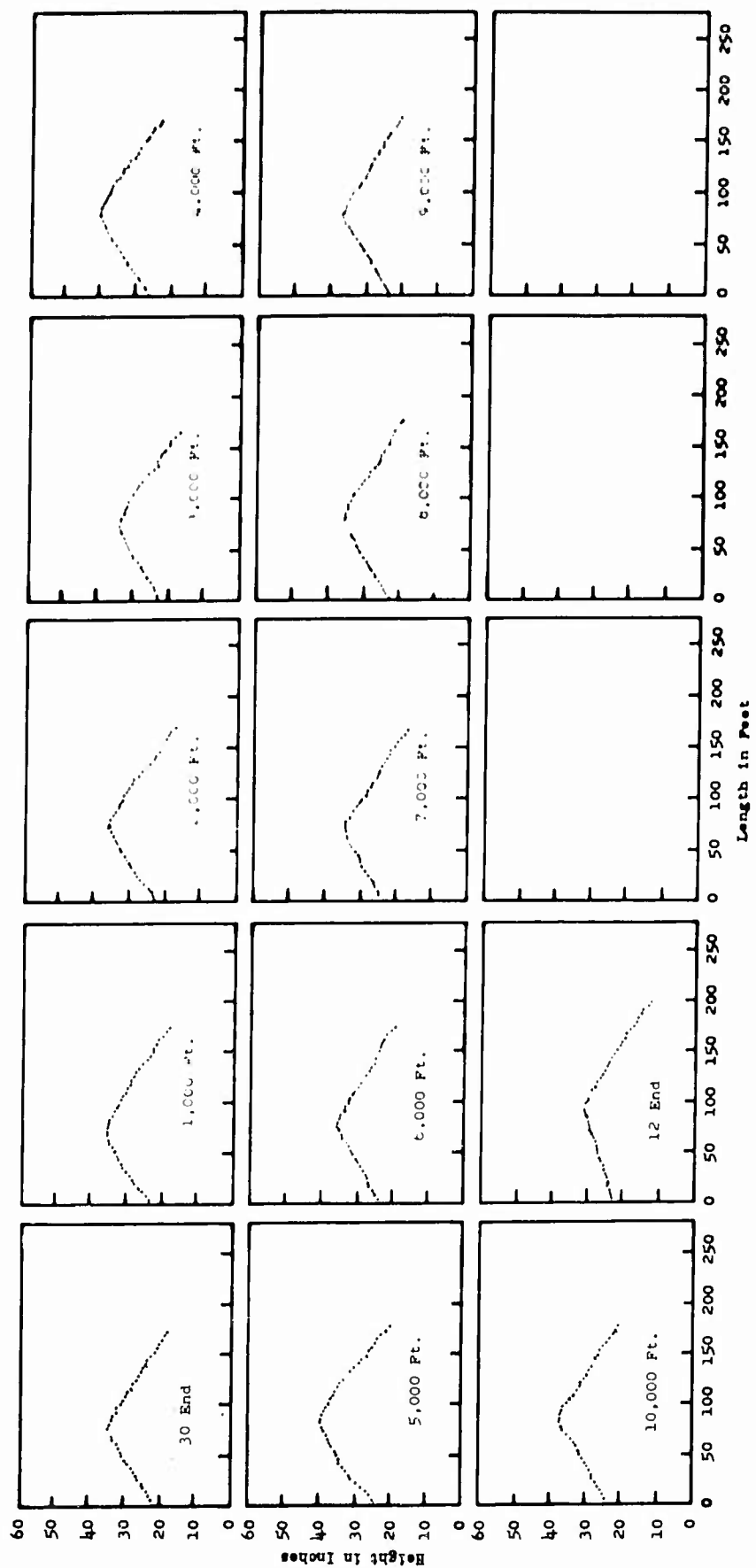


Figure 86 - Cross Run Profiles, Runway 30, Castle Air Force Base

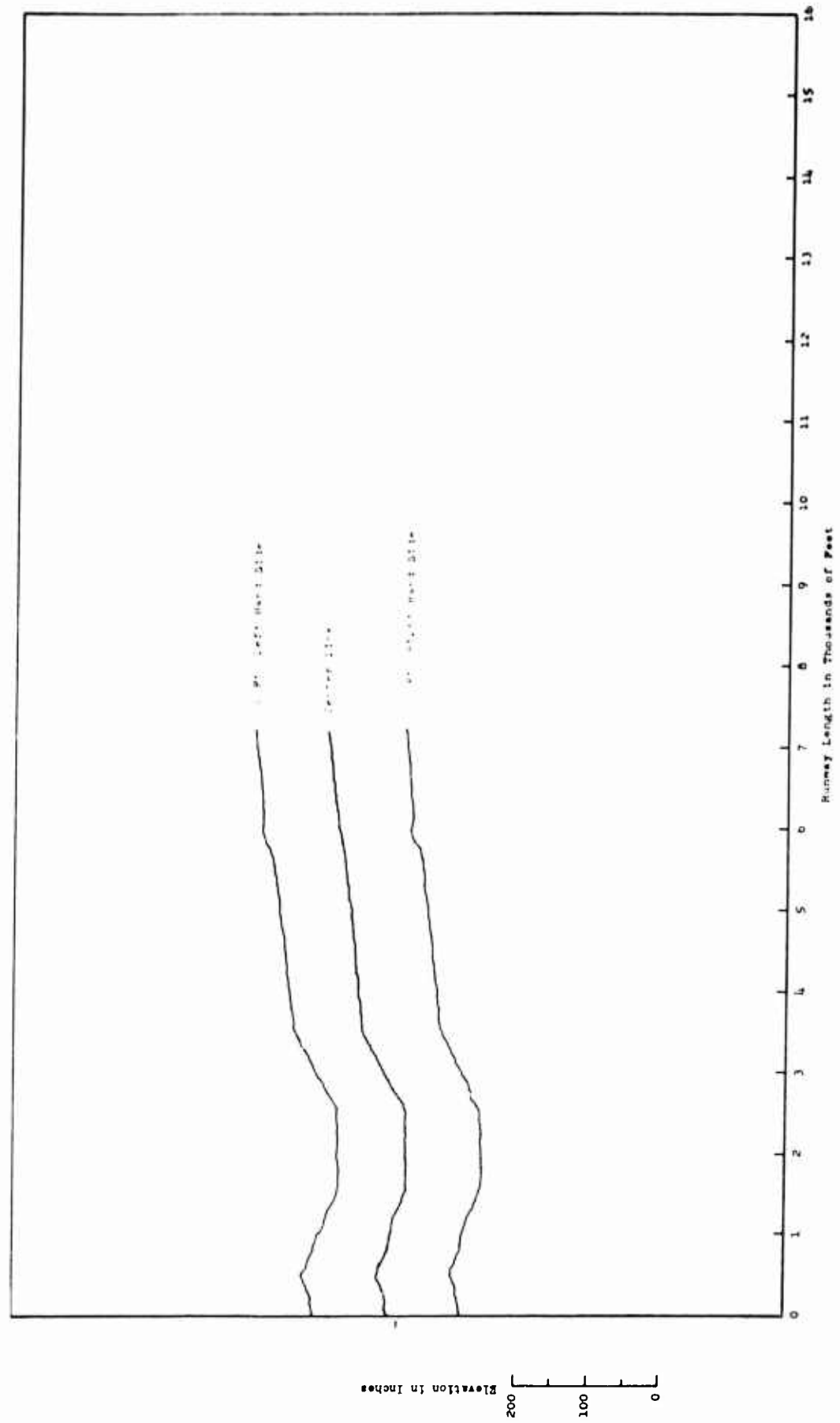


Figure 87 - Profiles, Taxiway 9, Castle Air Force Base

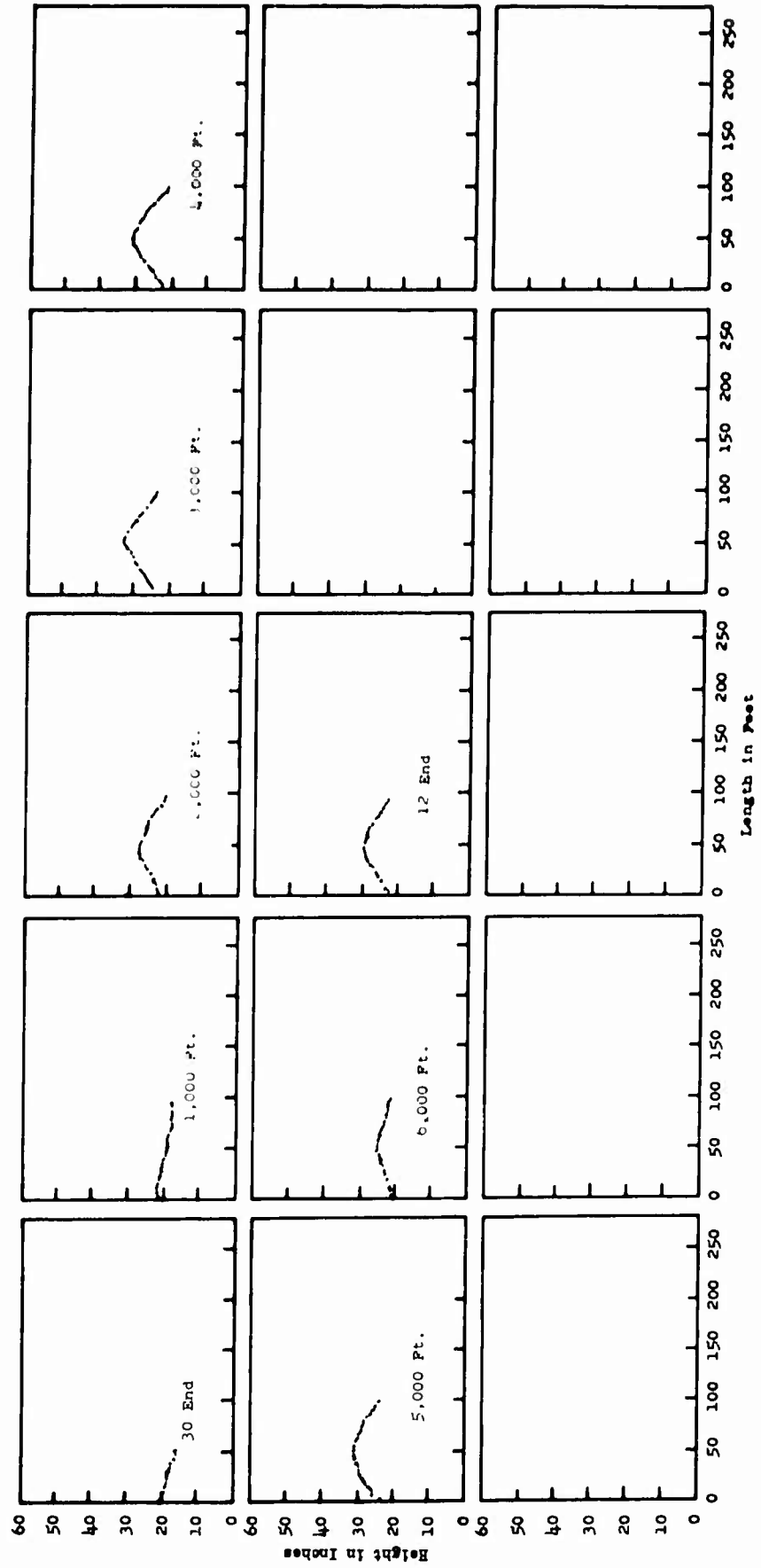


Figure 88 - Cross Run Profiles, Taxiway 9, Castle Air Force Base

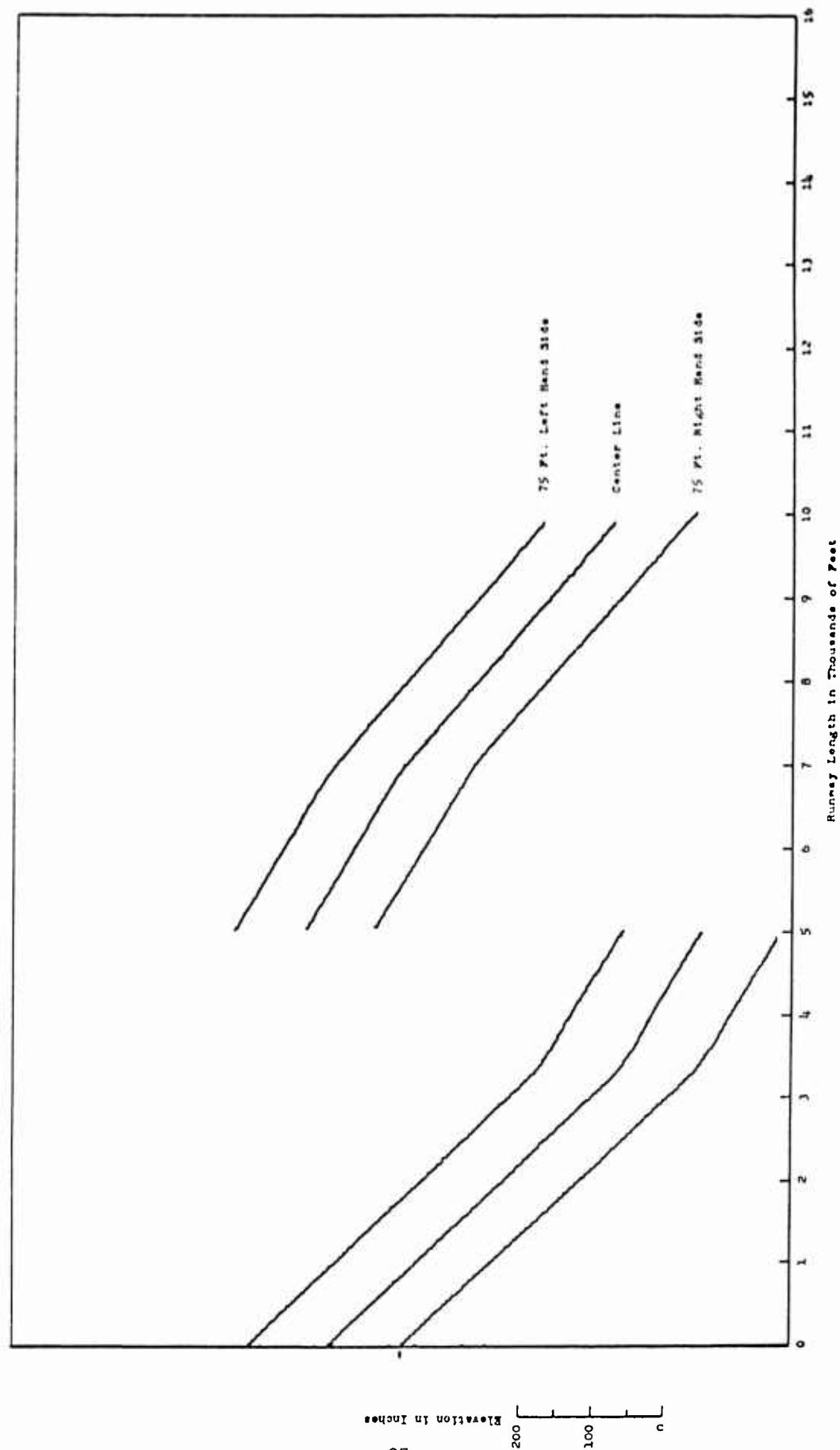


Figure 89 - Profiles, Runway 10, Dobbins Air Force Base

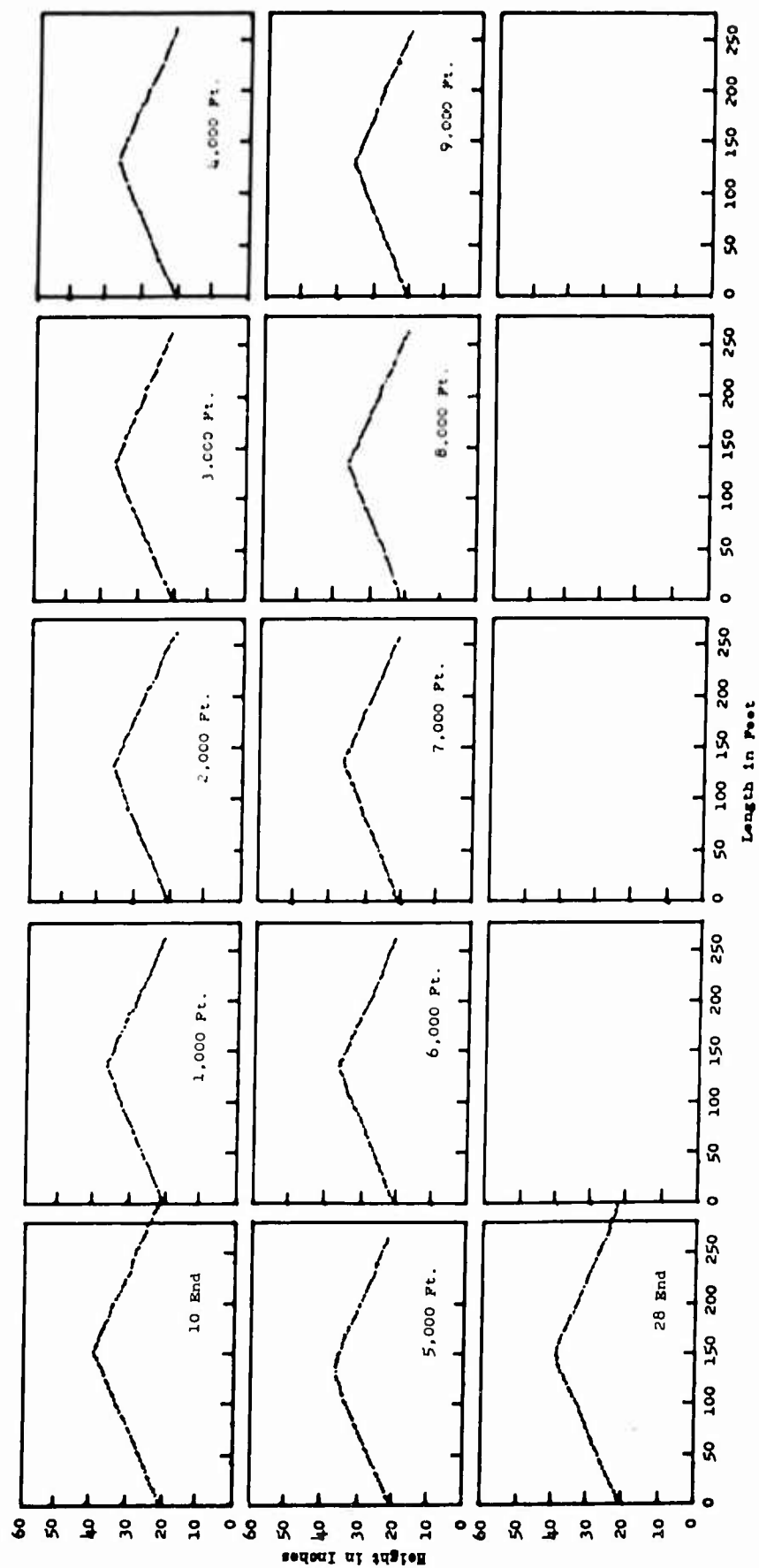


Figure 90 - Cross Run Profiles, Runway 10, Dobbins Air Force Base

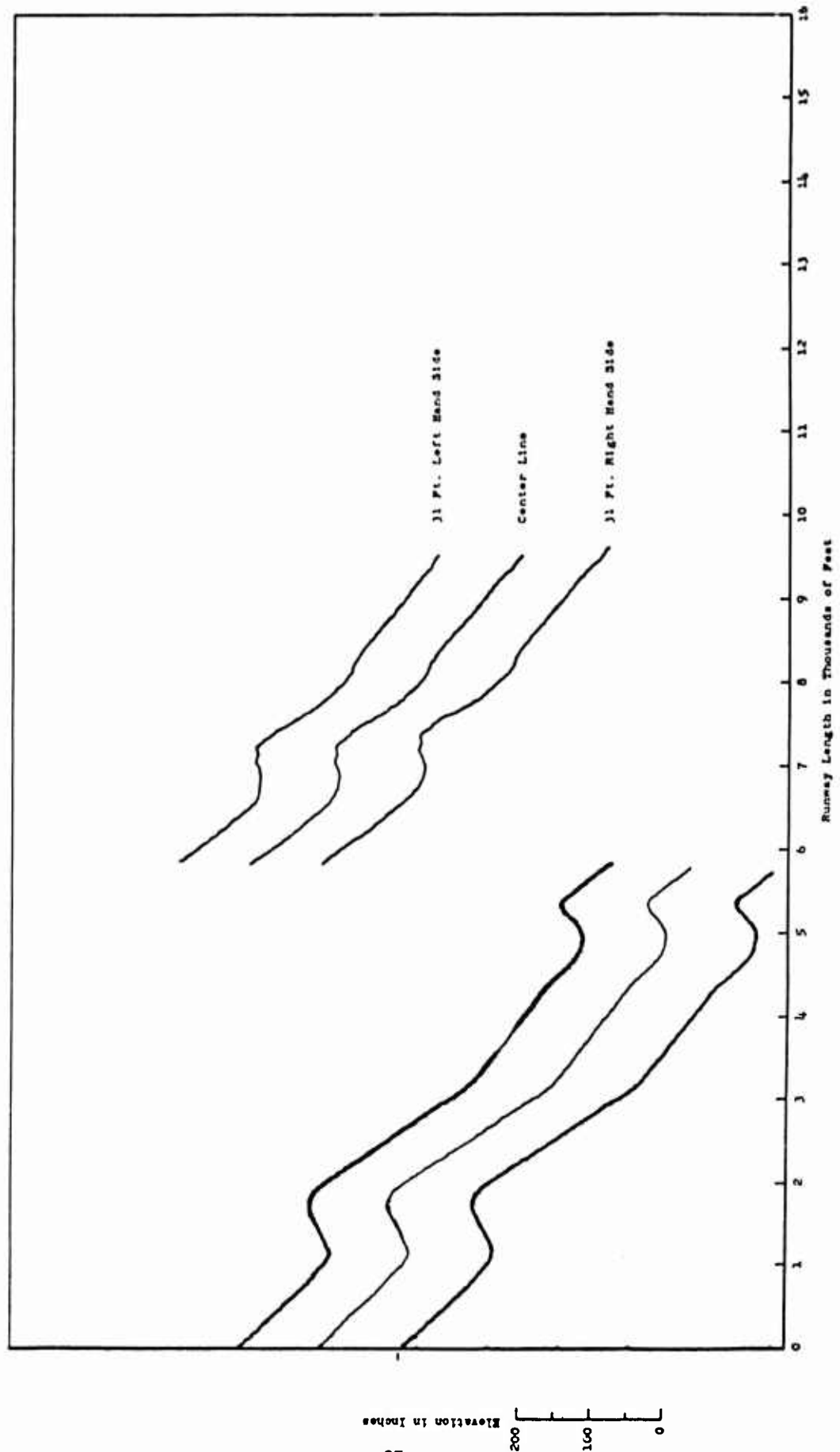


Figure 91 - Profiles, Taxiway 10, Dobbins Air Force Base

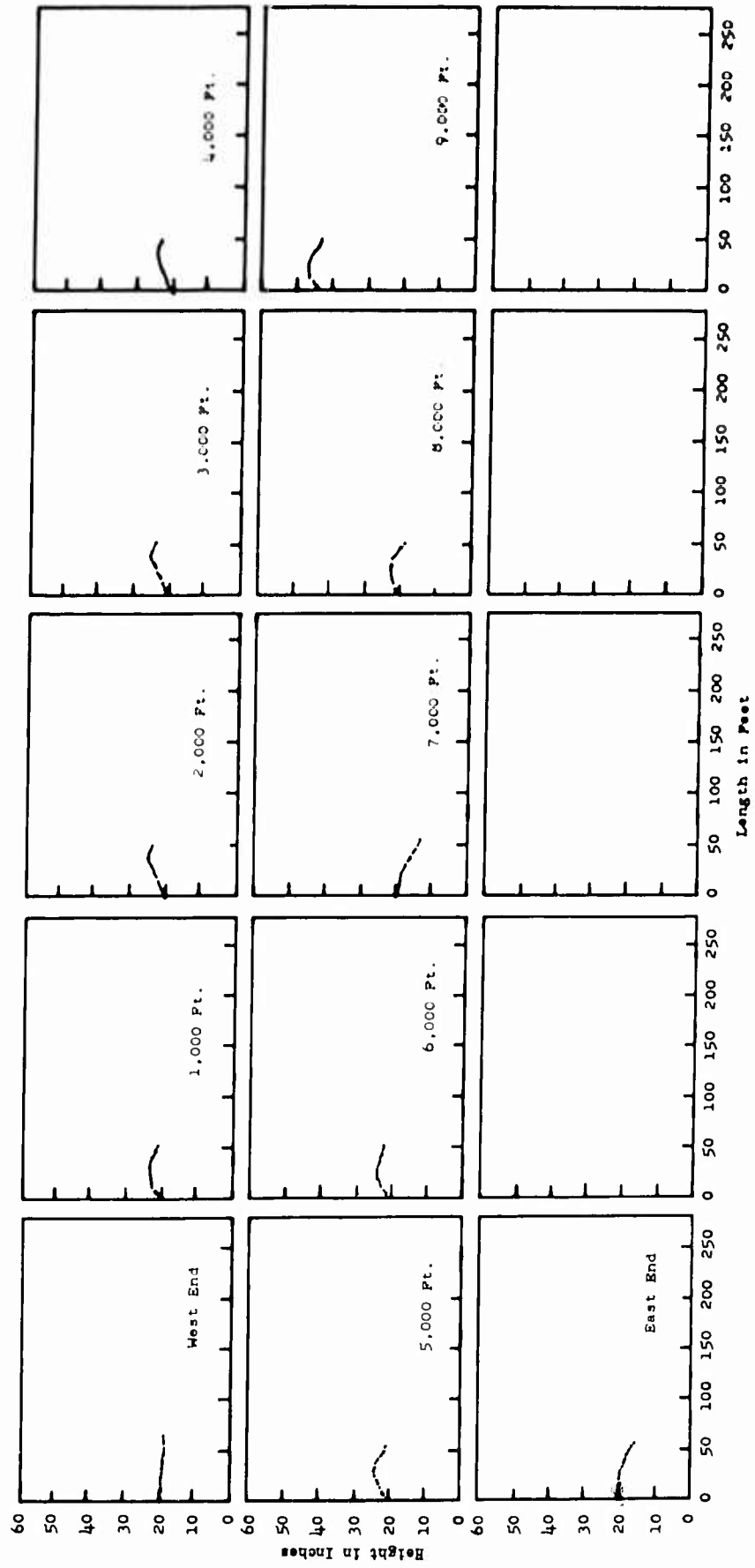


Figure 92 - Cross Run Profiles, Taxiway 10, Dobbins Air Force Base

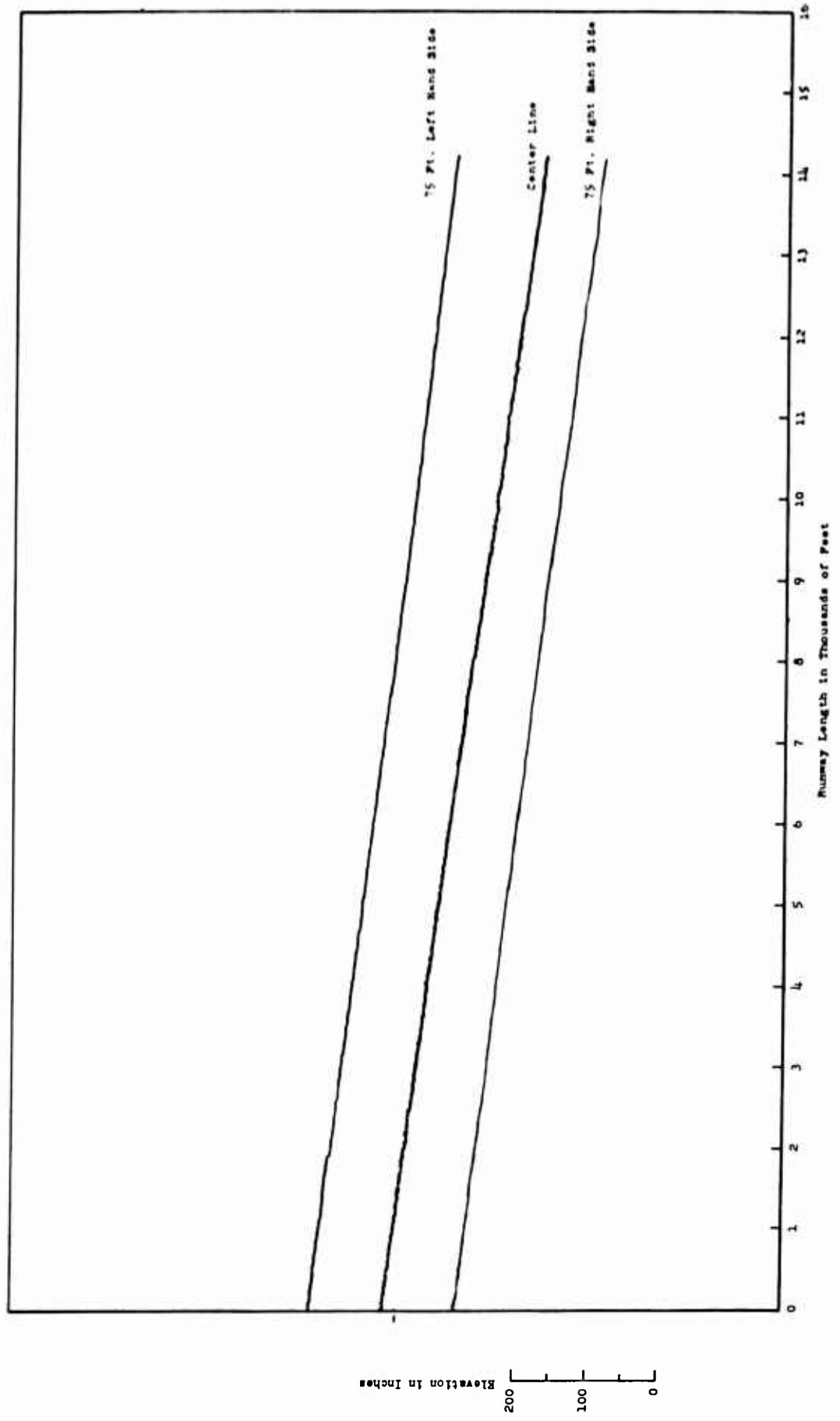


Figure 93 - Profiles, Runway 4, Edwards Air Force Base

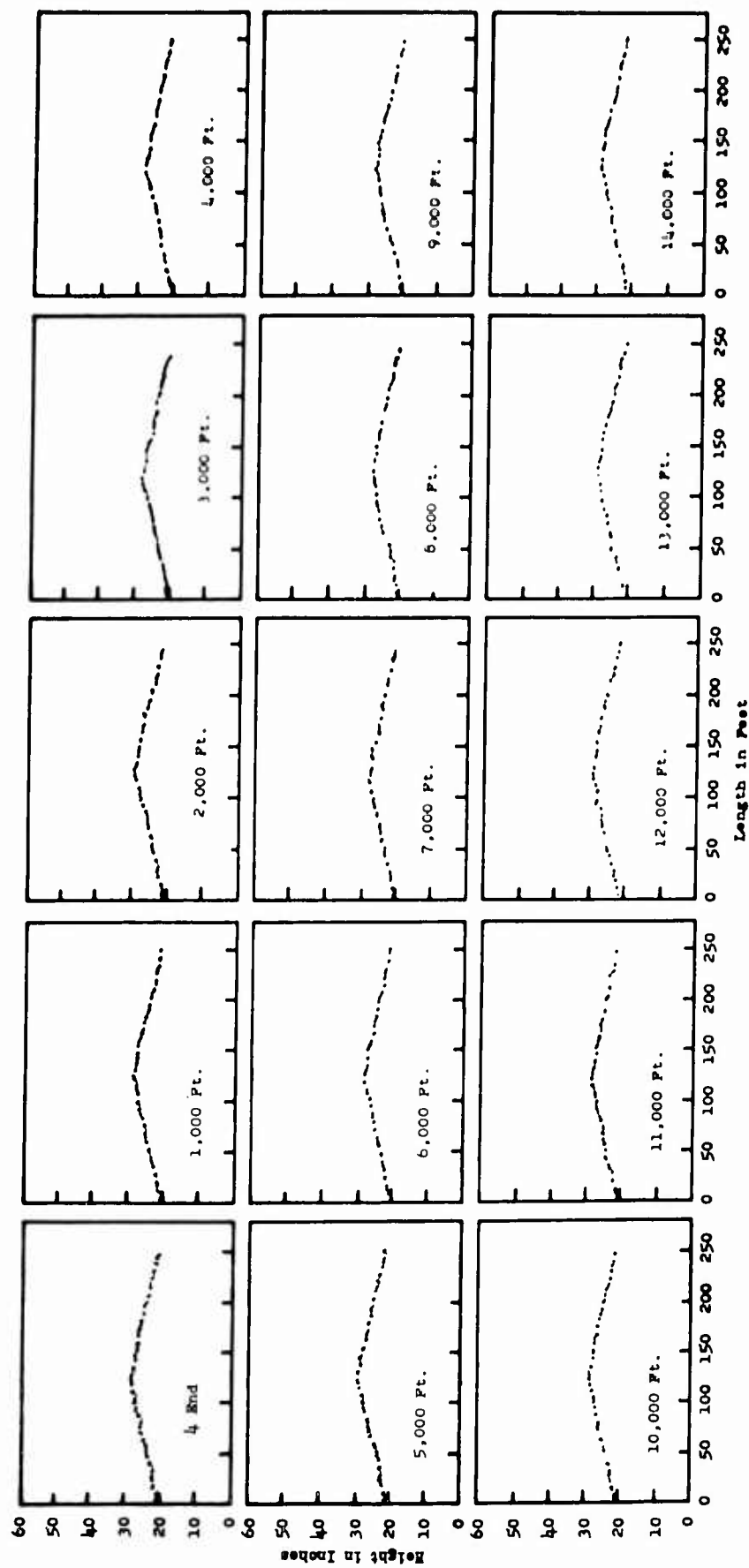


Figure 94 - Cross Run Profiles, Runway 4, Edwards Air Force Base

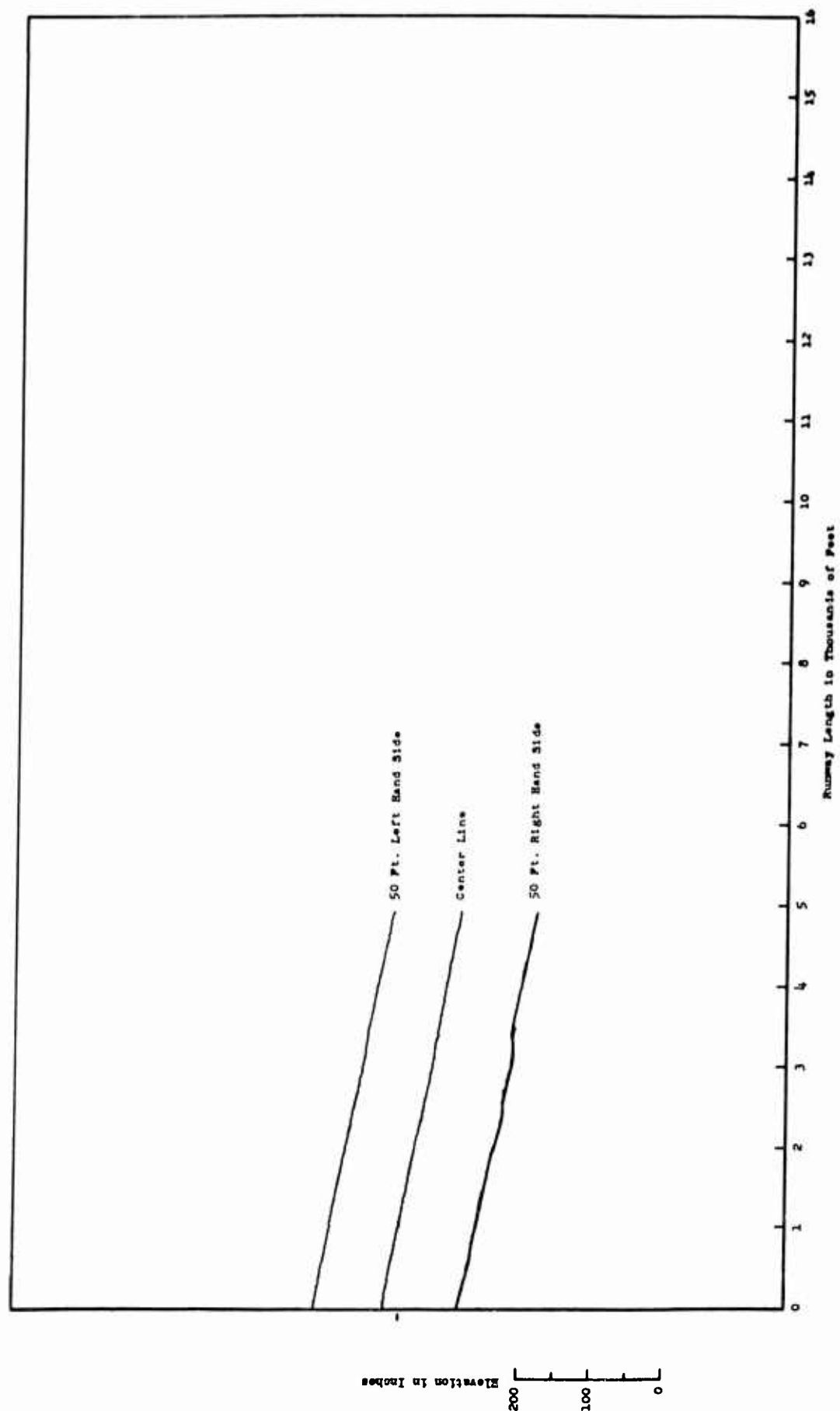


Figure 95 - Profiles, West Taxiway, Edwards Air Force Base

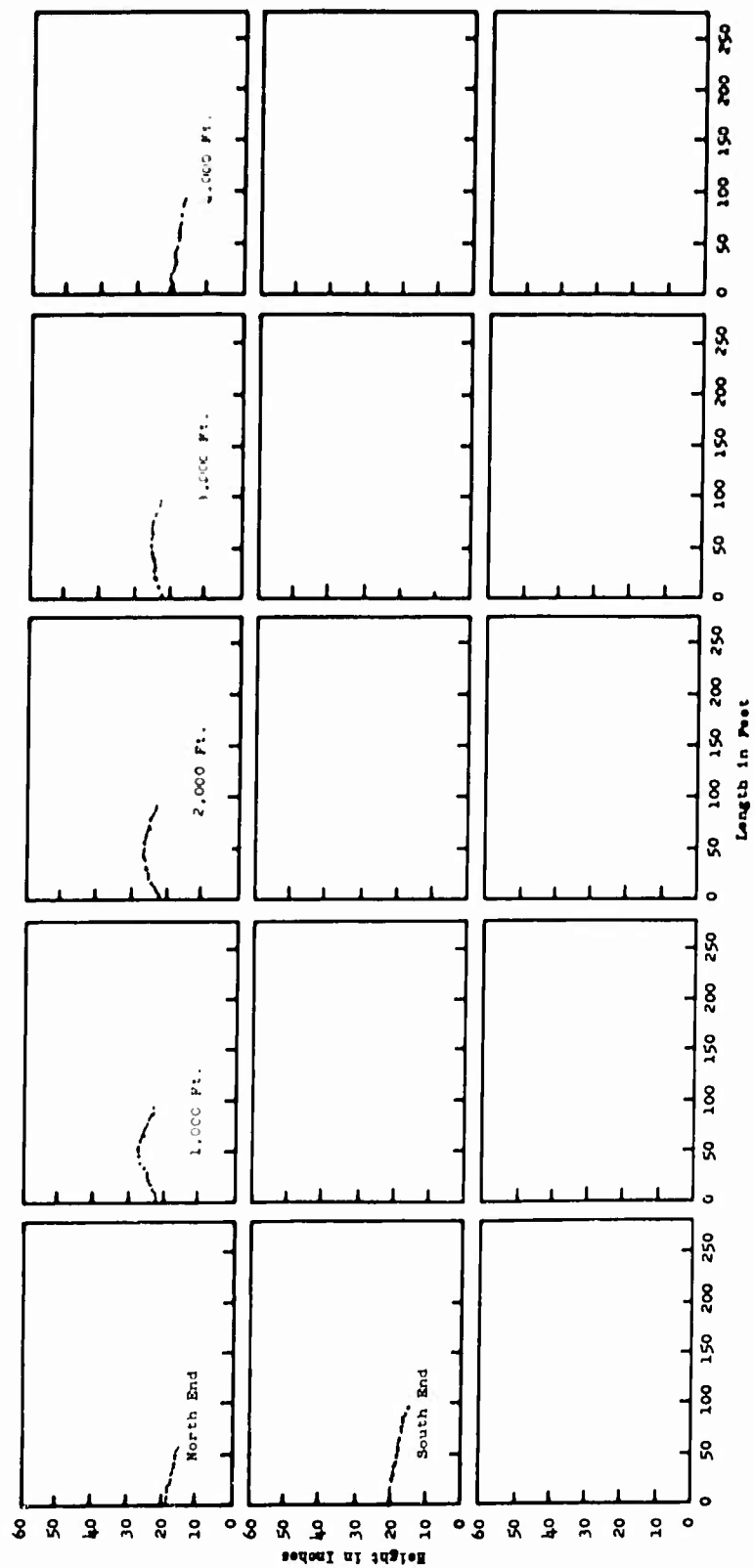


Figure 96 - Cross Run Profiles, West Taxiway, Edwards Air Force Base

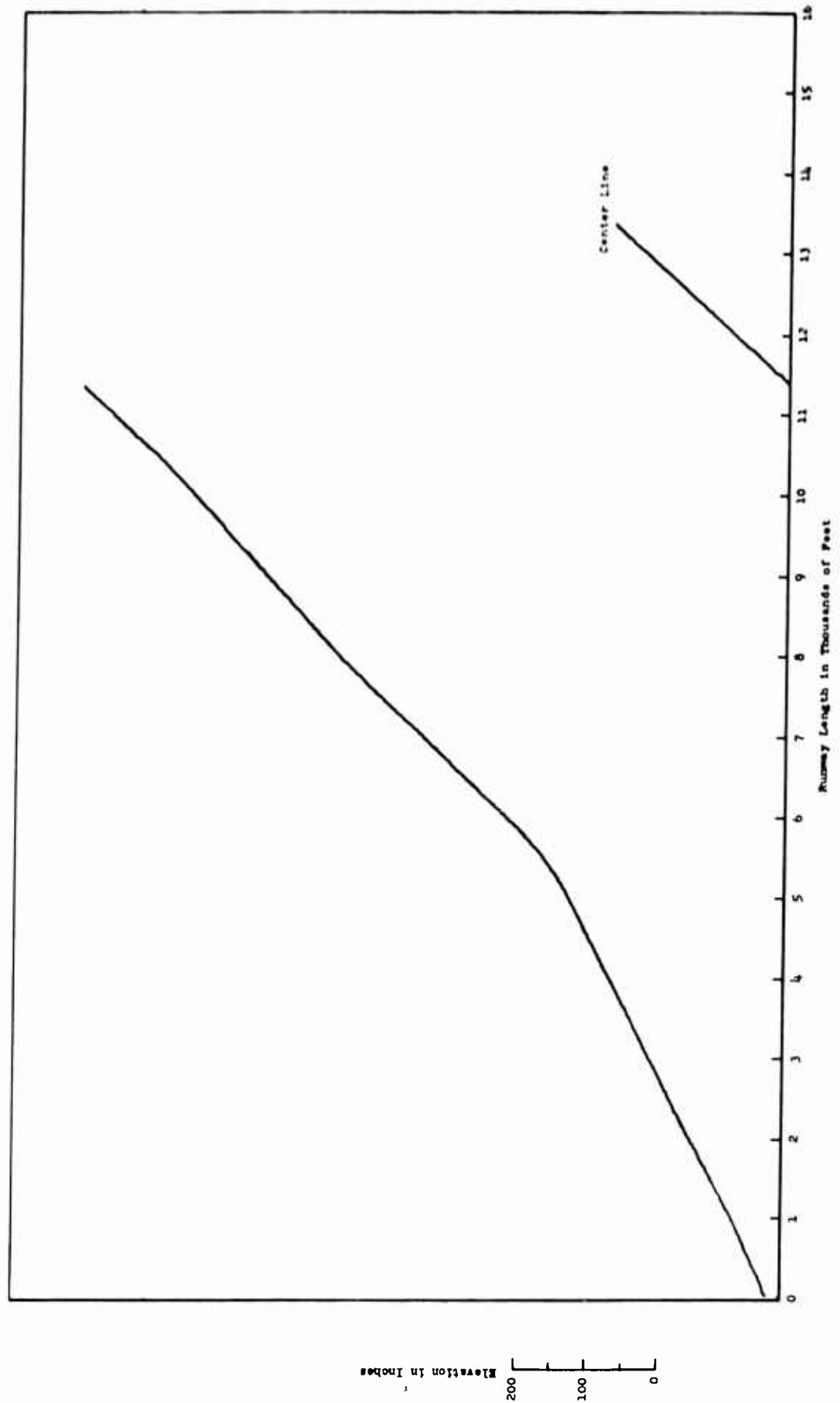


Figure 97 - Profiles, Runway 30, Ellsworth Air Force Base

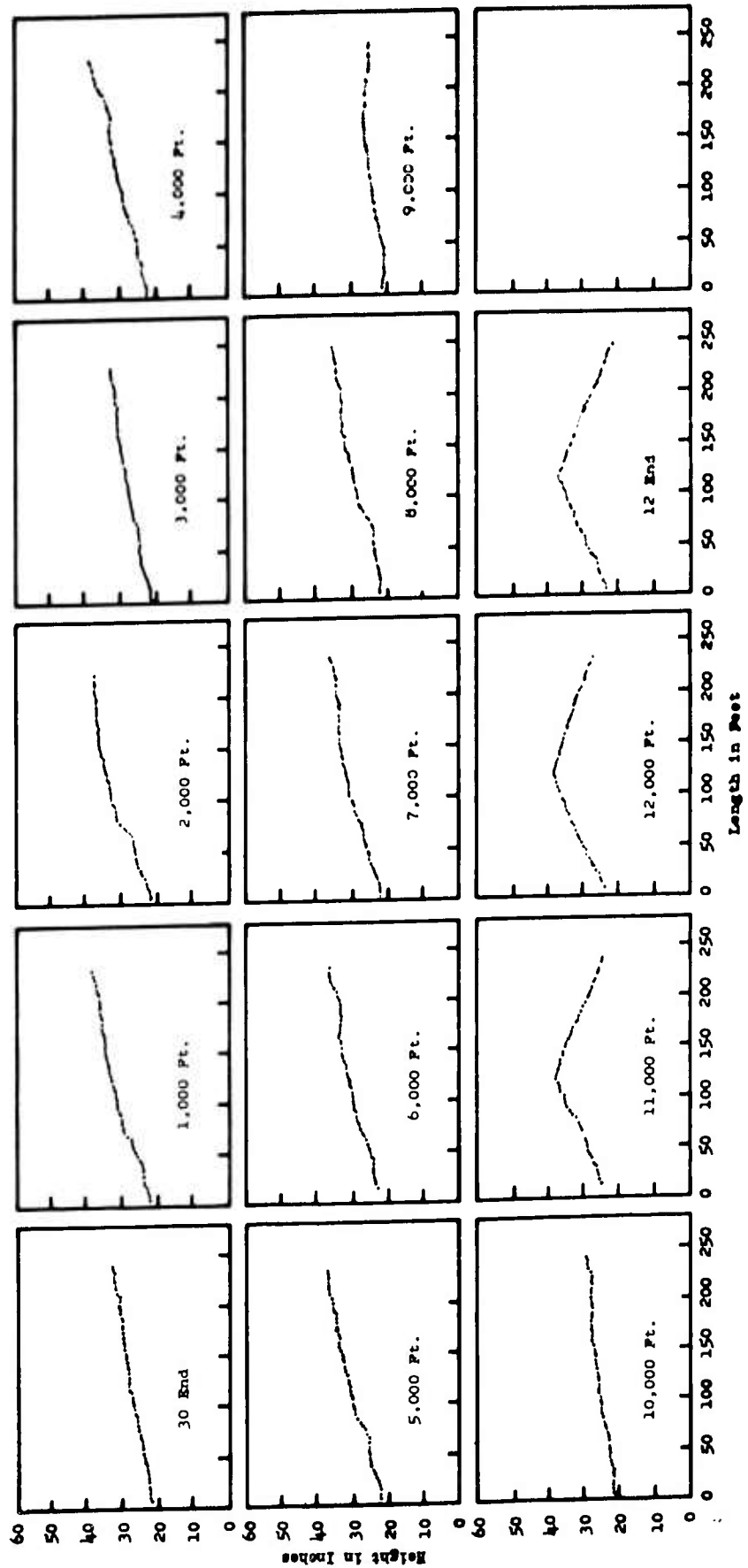


Figure 98 - Cross Run Profiles, Runway 30, Ellsworth Air Force Base

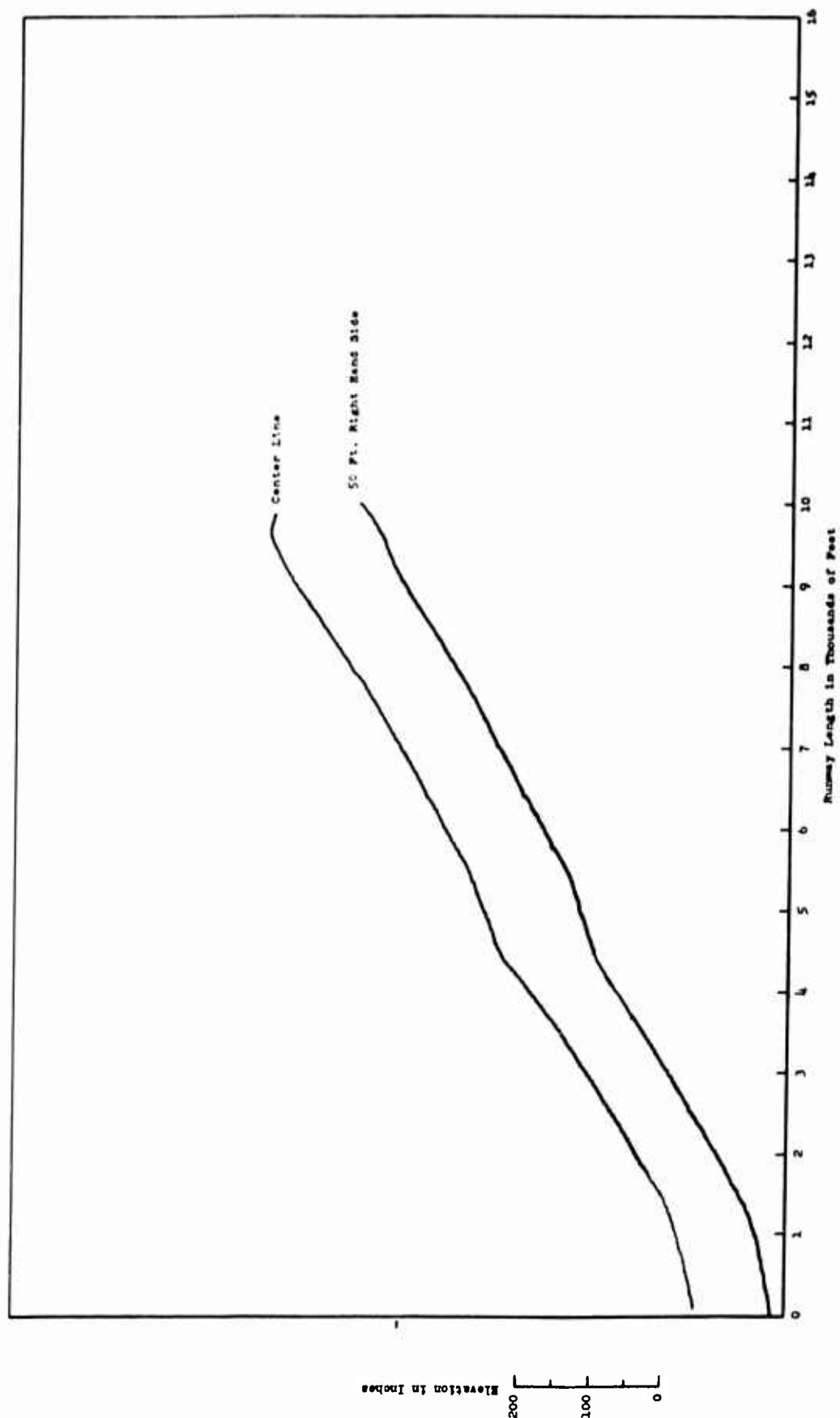


Figure 99 - Profiles, Runway 16, George Air Force Base

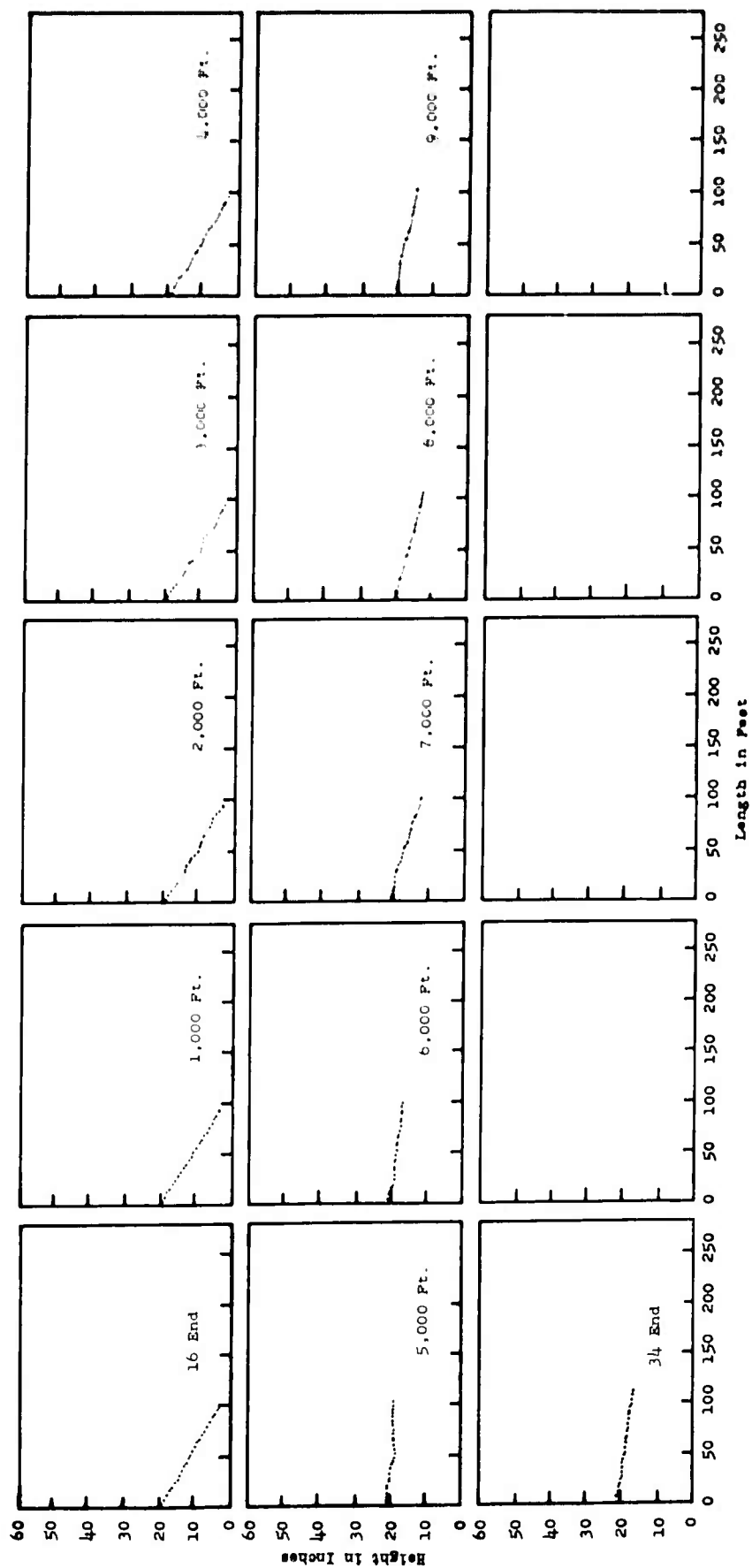


Figure 100 - Cross Run Profiles, Runway 16, George Air Force Base

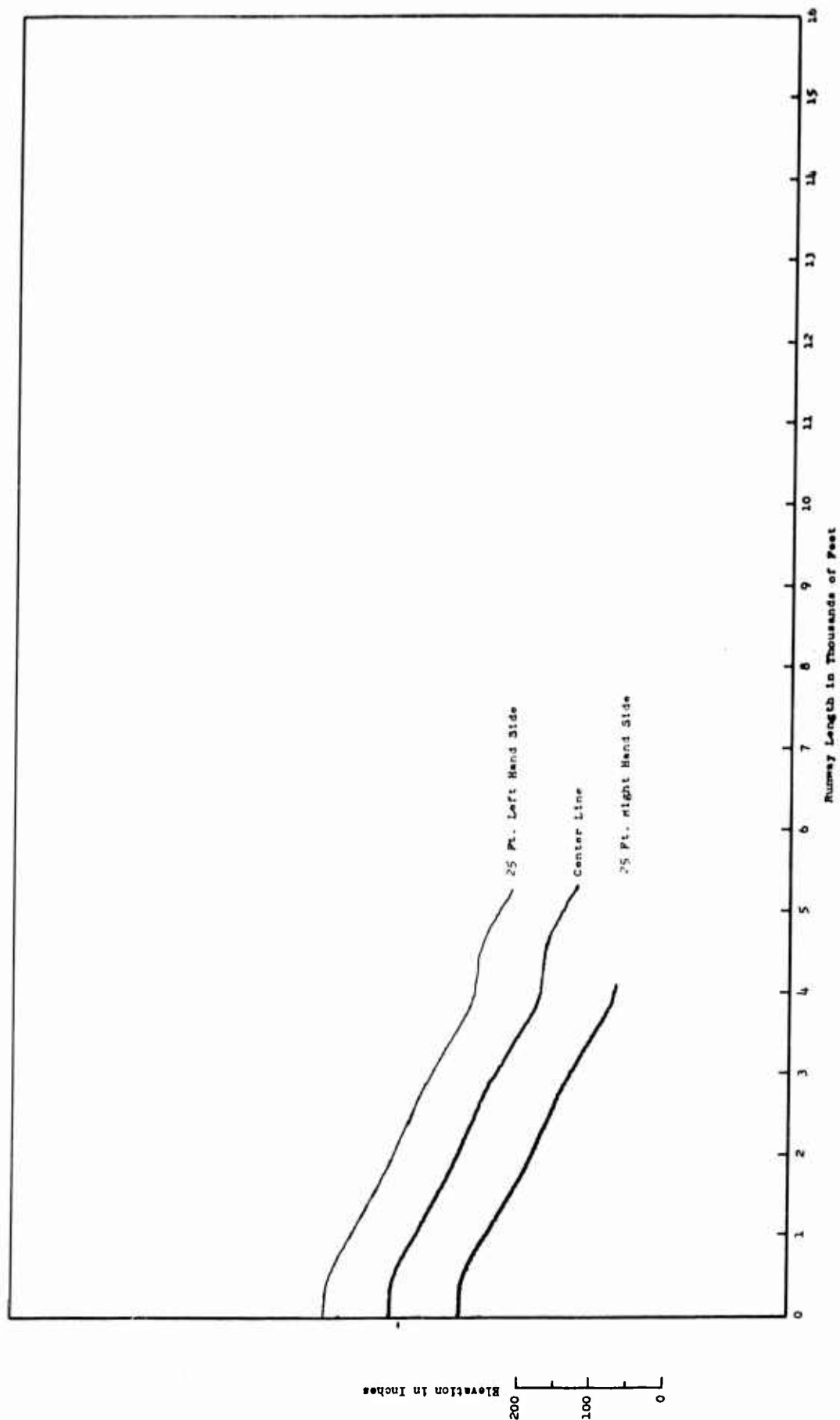


Figure 101 - Profiles, Taxiway 5, George Air Force Base

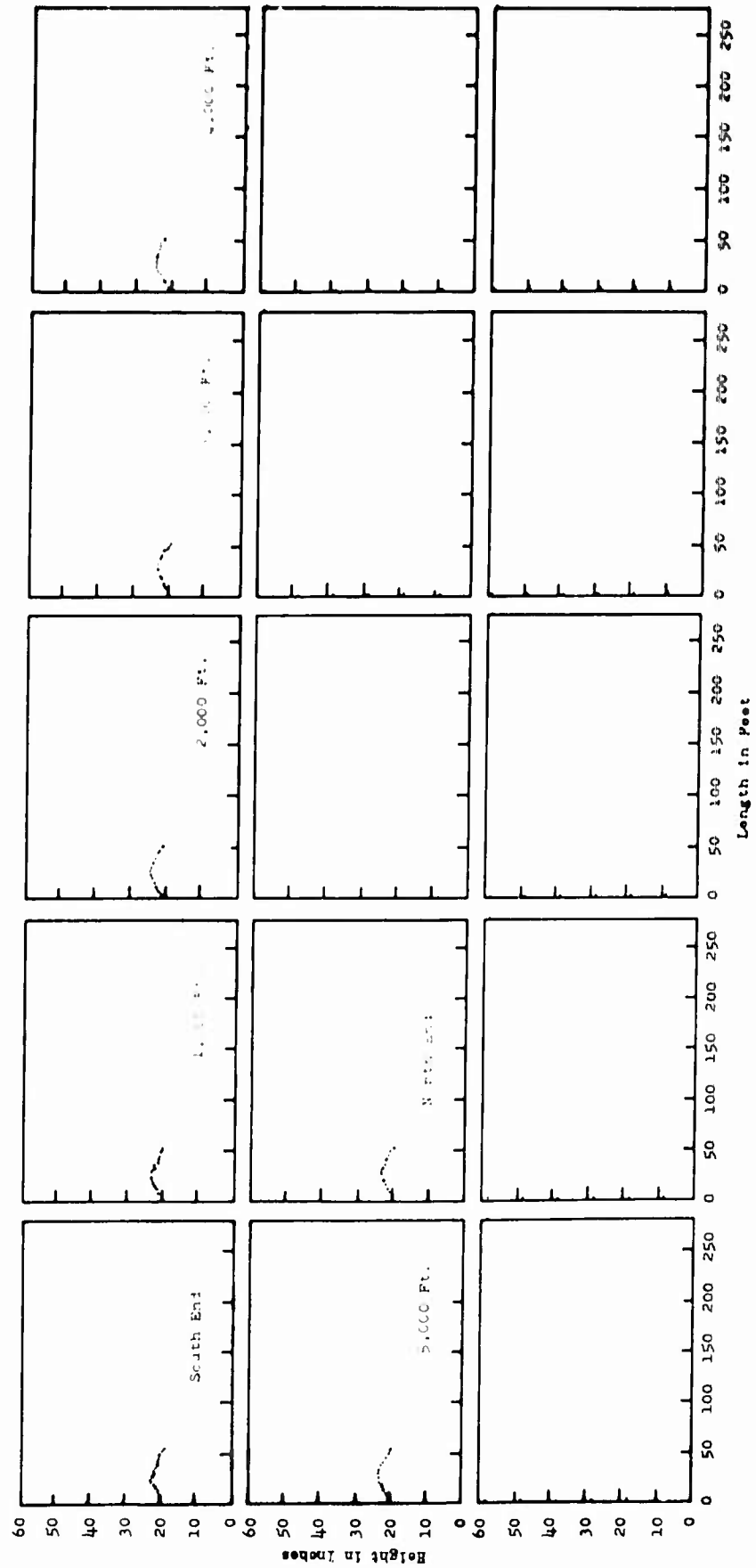


Figure 102 - Cross Run Profiles, Taxiway 5, George Air Force Base

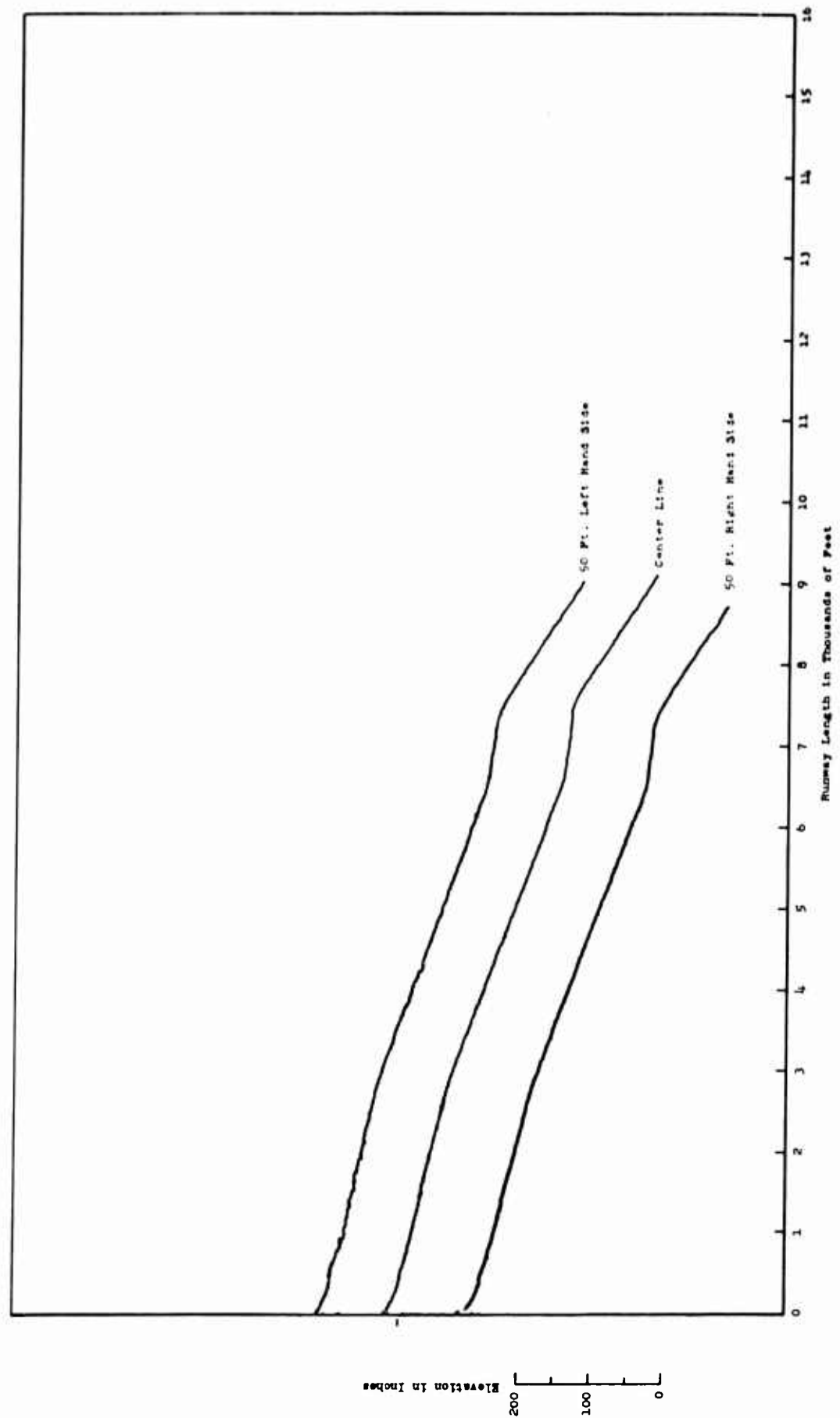


Figure 103 - Profiles, Runway 3, George Air Force Base

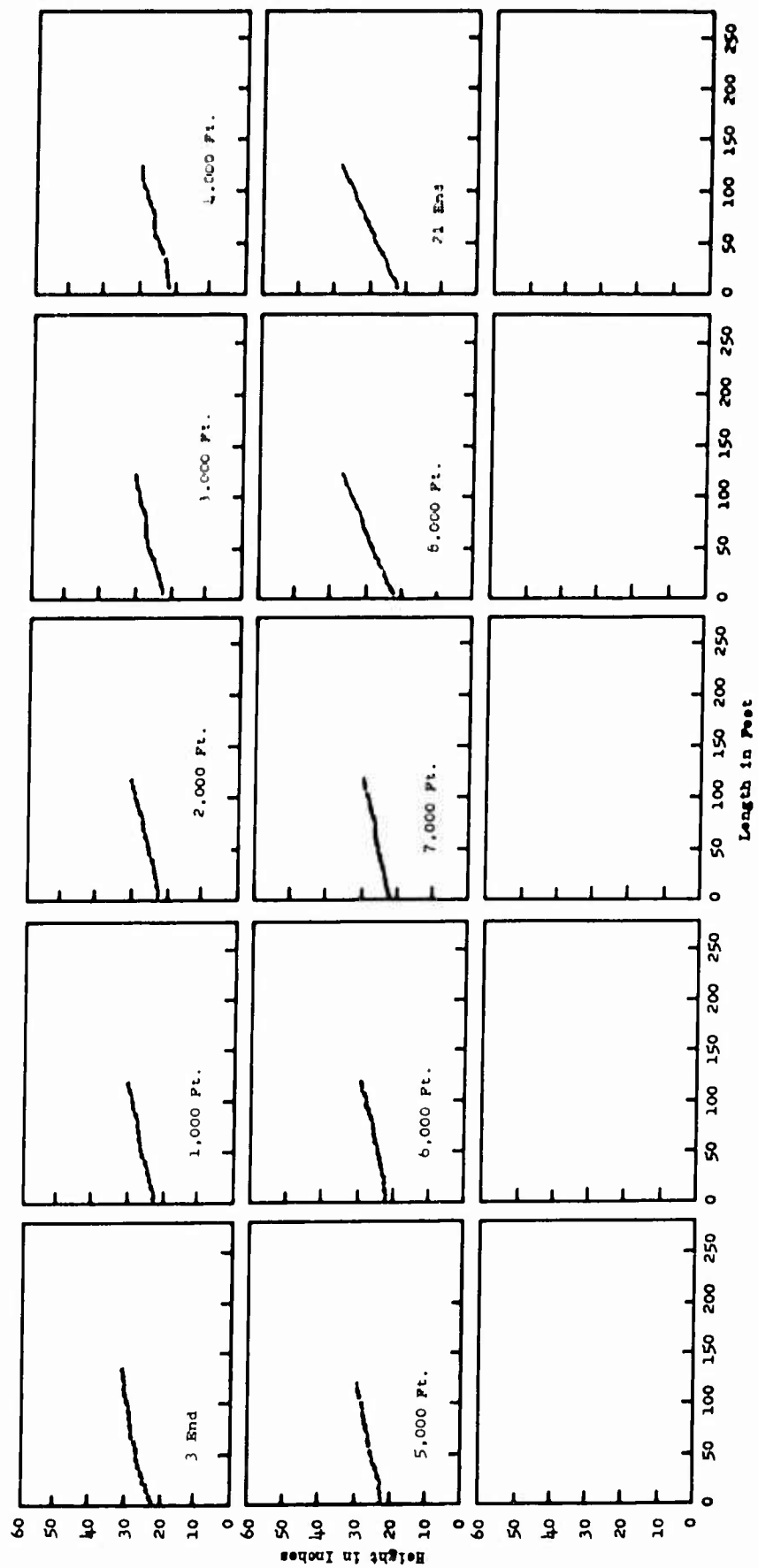


Figure 104 - Cross Run Profiles, Runway 3, George Air Force Base

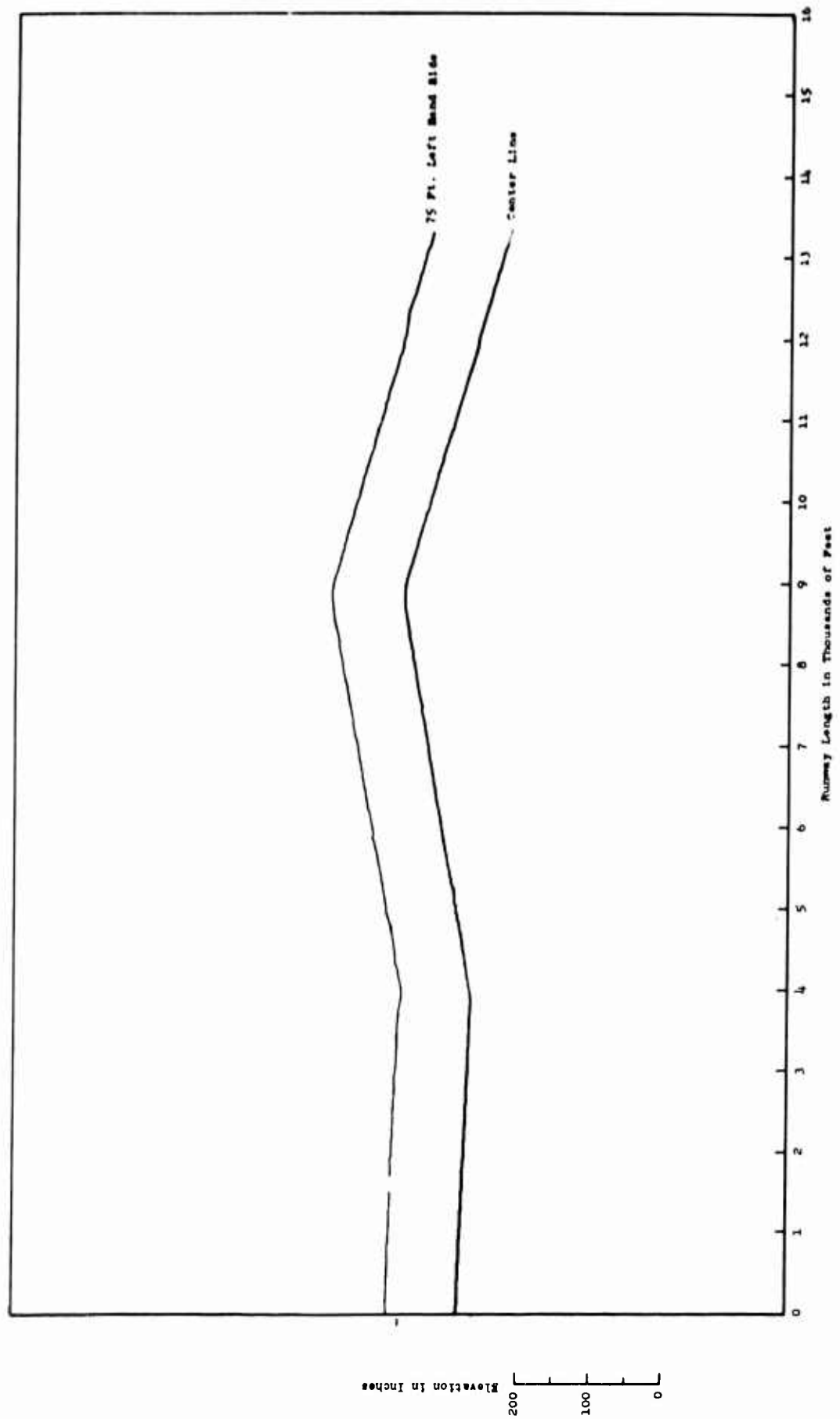


Figure 105 - Profiles, Runway 10, Glasgow Air Force Base

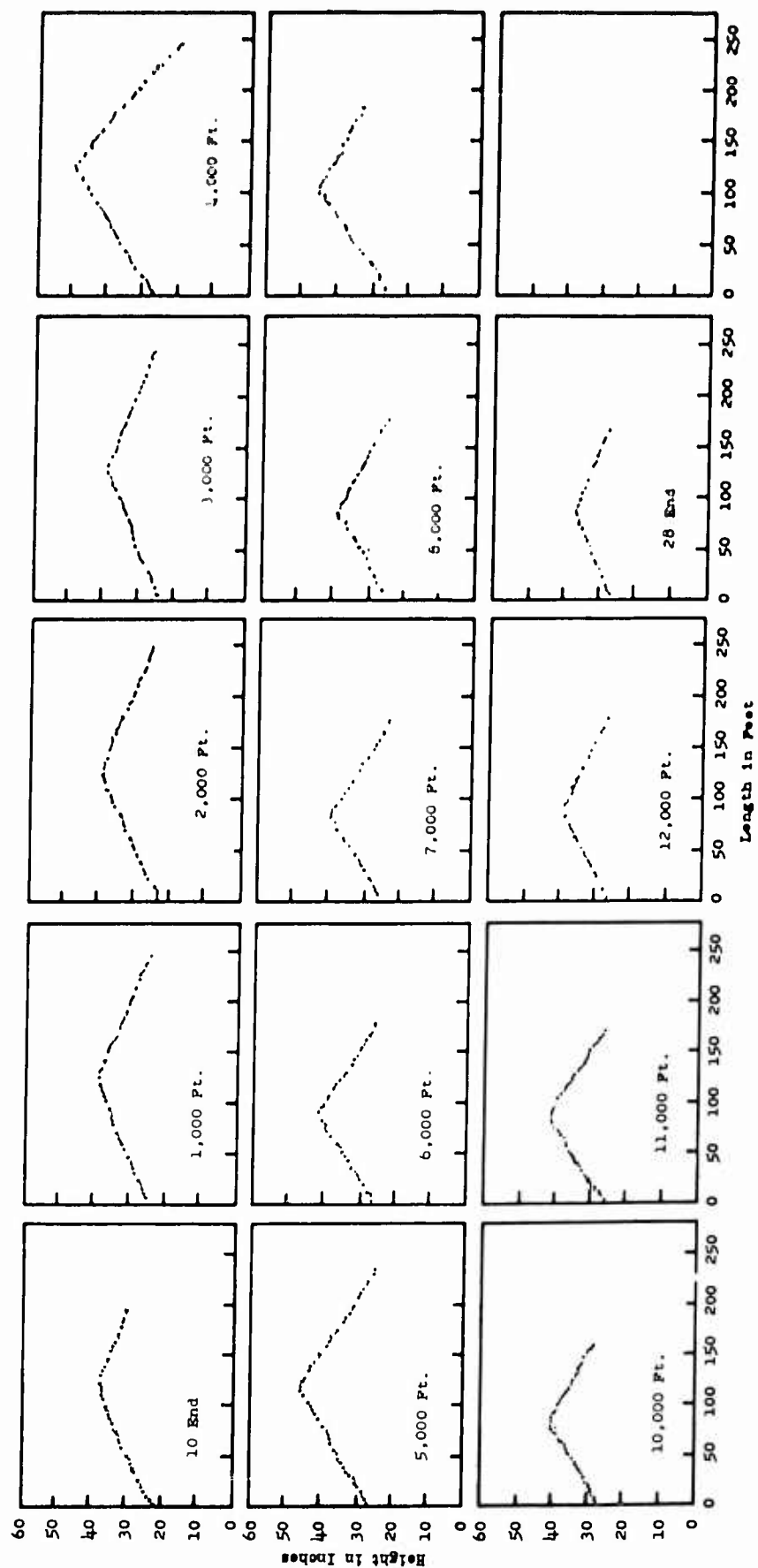


Figure 106 - Cross Run Profiles, Runway 10, Glasgow Air Force Base

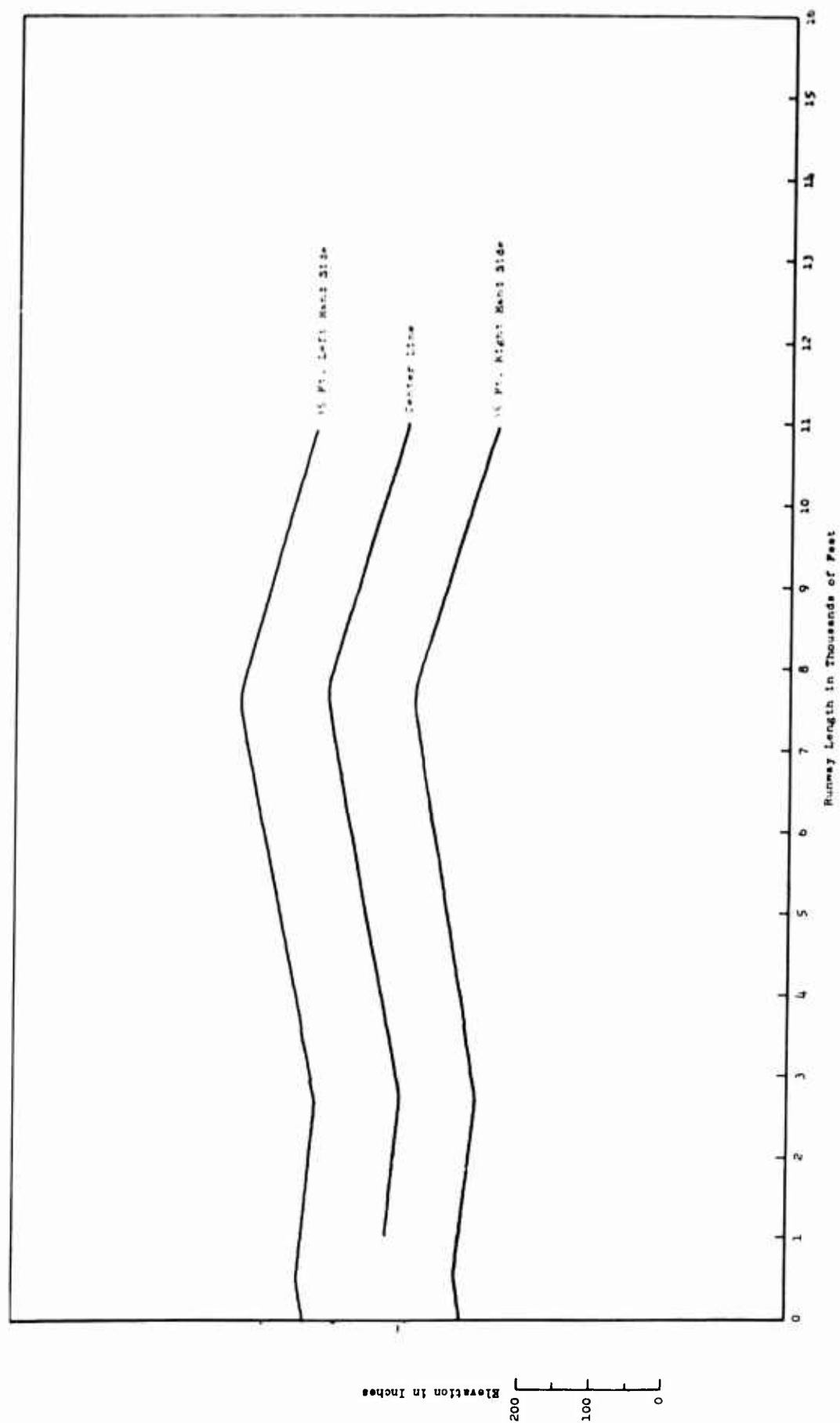


Figure 107 - Profiles, Taxiway 10, Glasgow Air Force Base

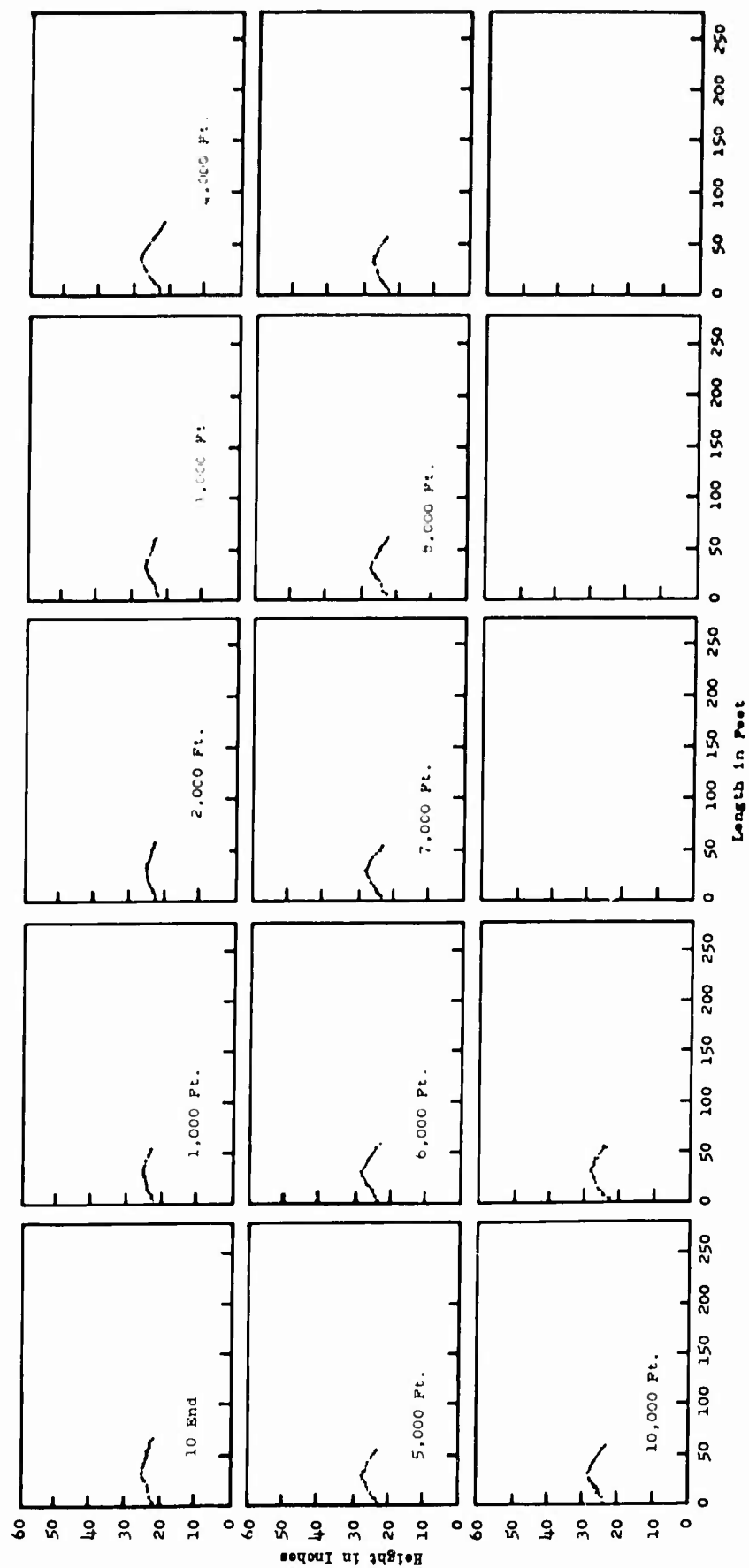


Figure 108 - Cross Run Profiles, Taxiway 10, Glasgow Air Force Base

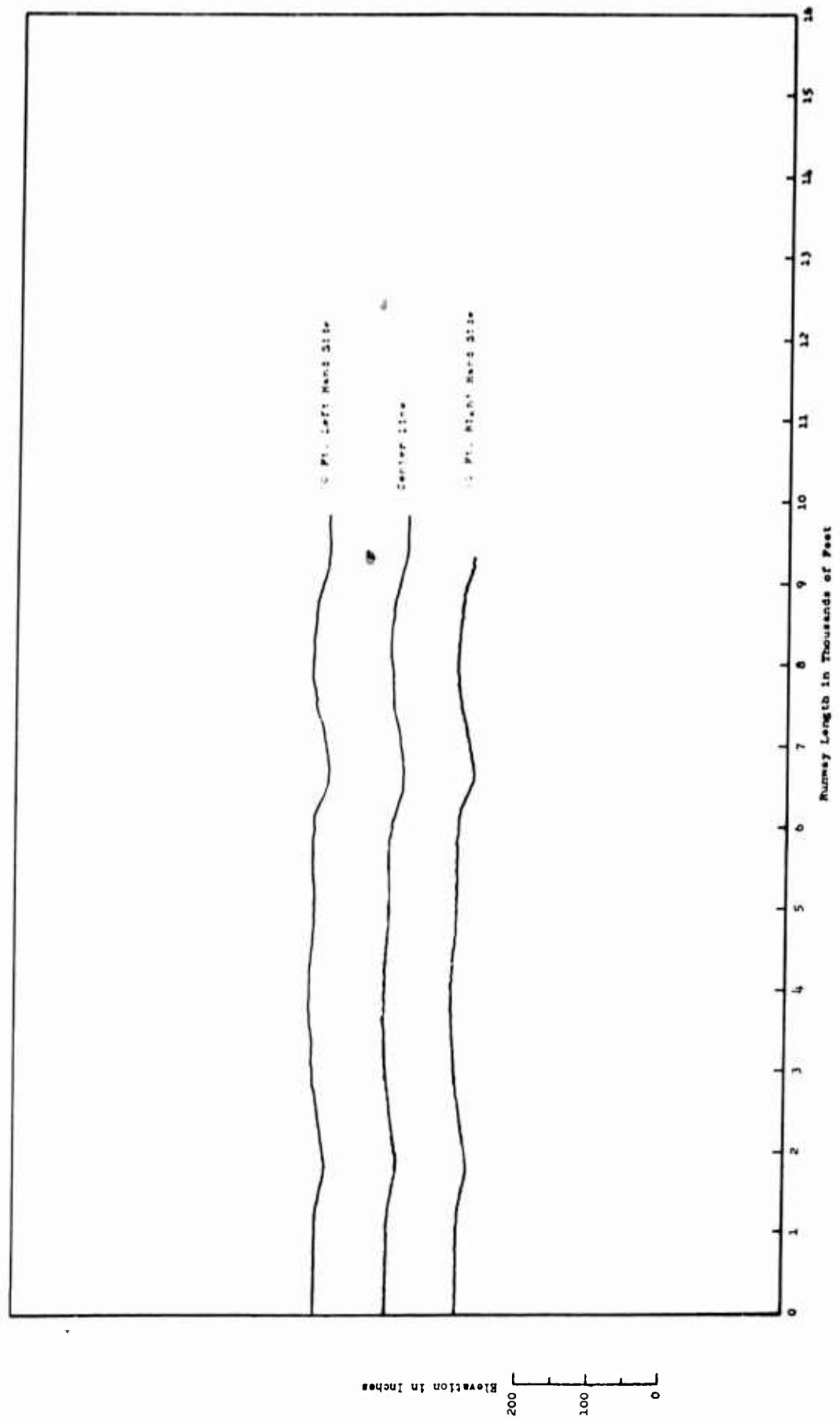


Figure 109 - Profiles, Runway 7, Langley Air Force Base

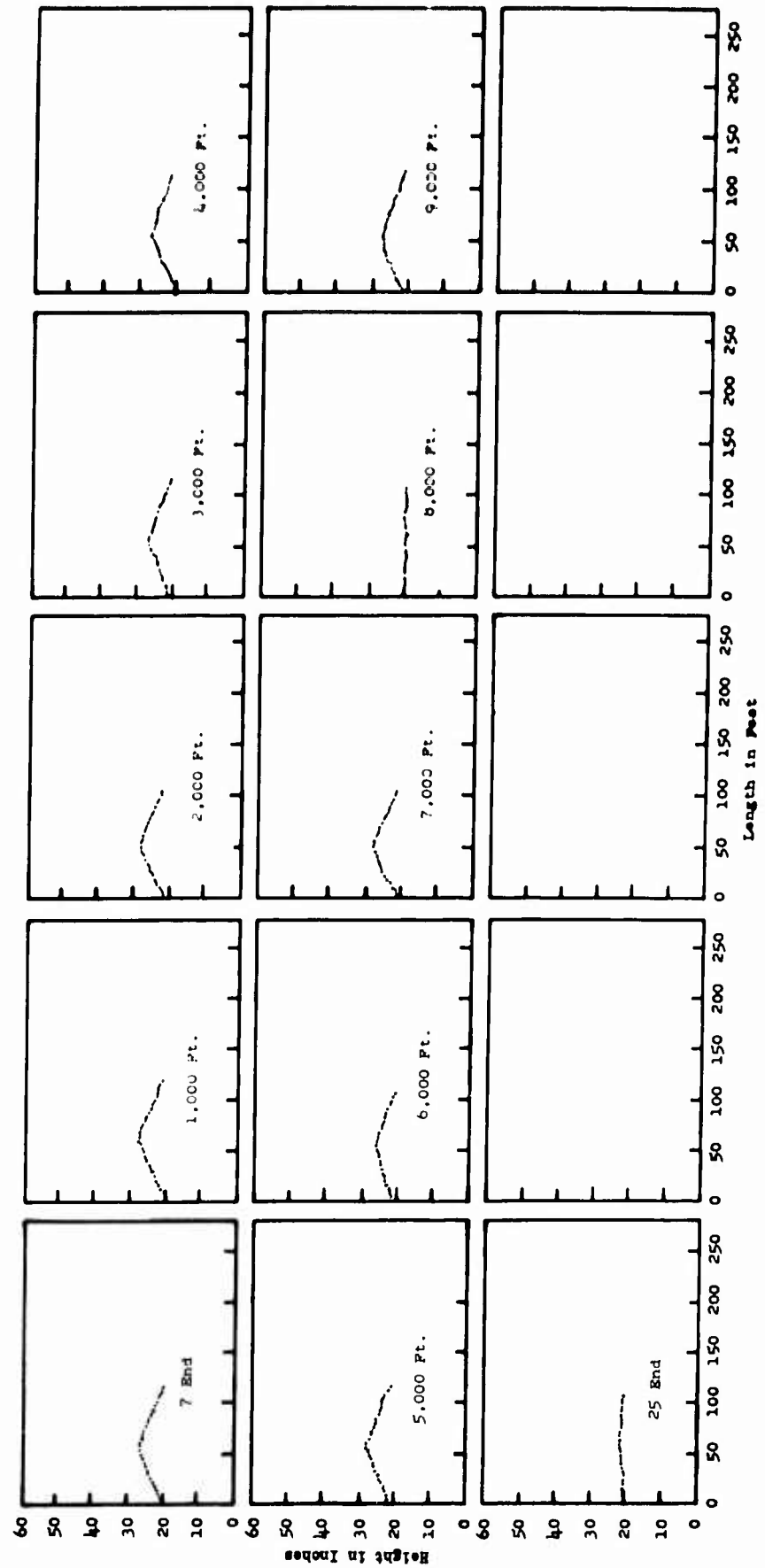


Figure 110 - Cross Run Profiles, Runway 7, Langley Air Force Base

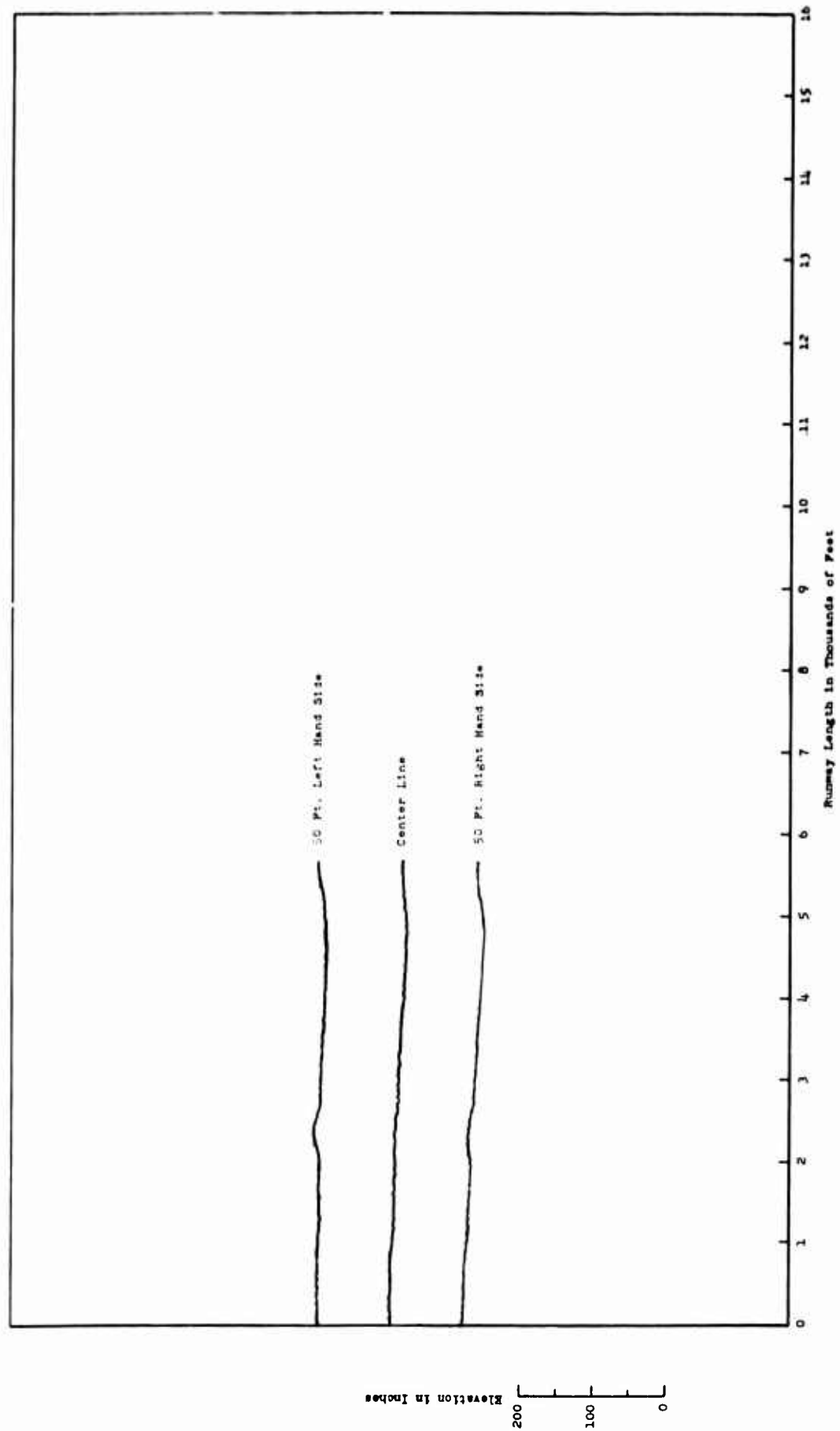


Figure 111 - Profiles, Runway 35, Langley Air Force Base

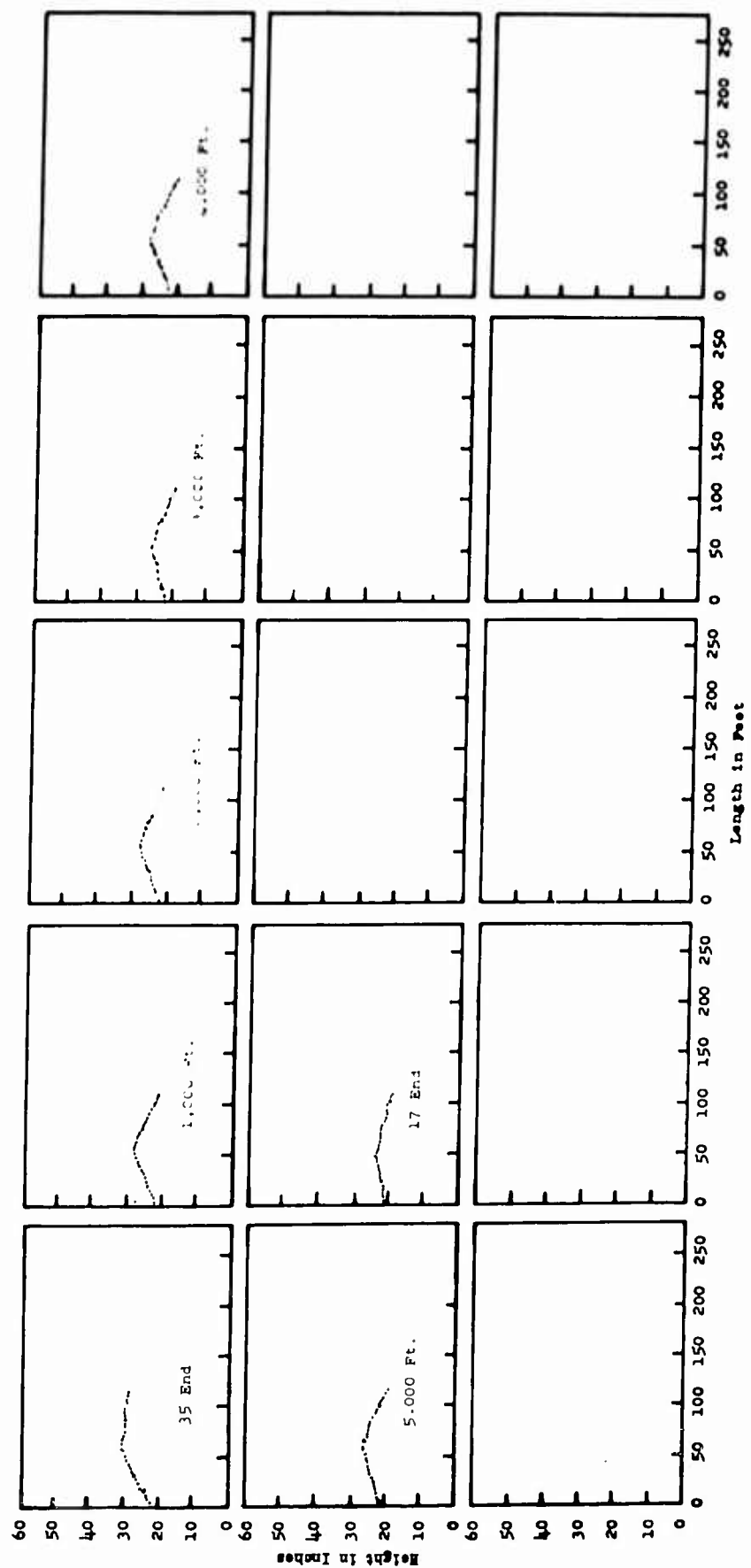


Figure 112 - Cross Run Profiles, Runway 35, Langley Air Force Base

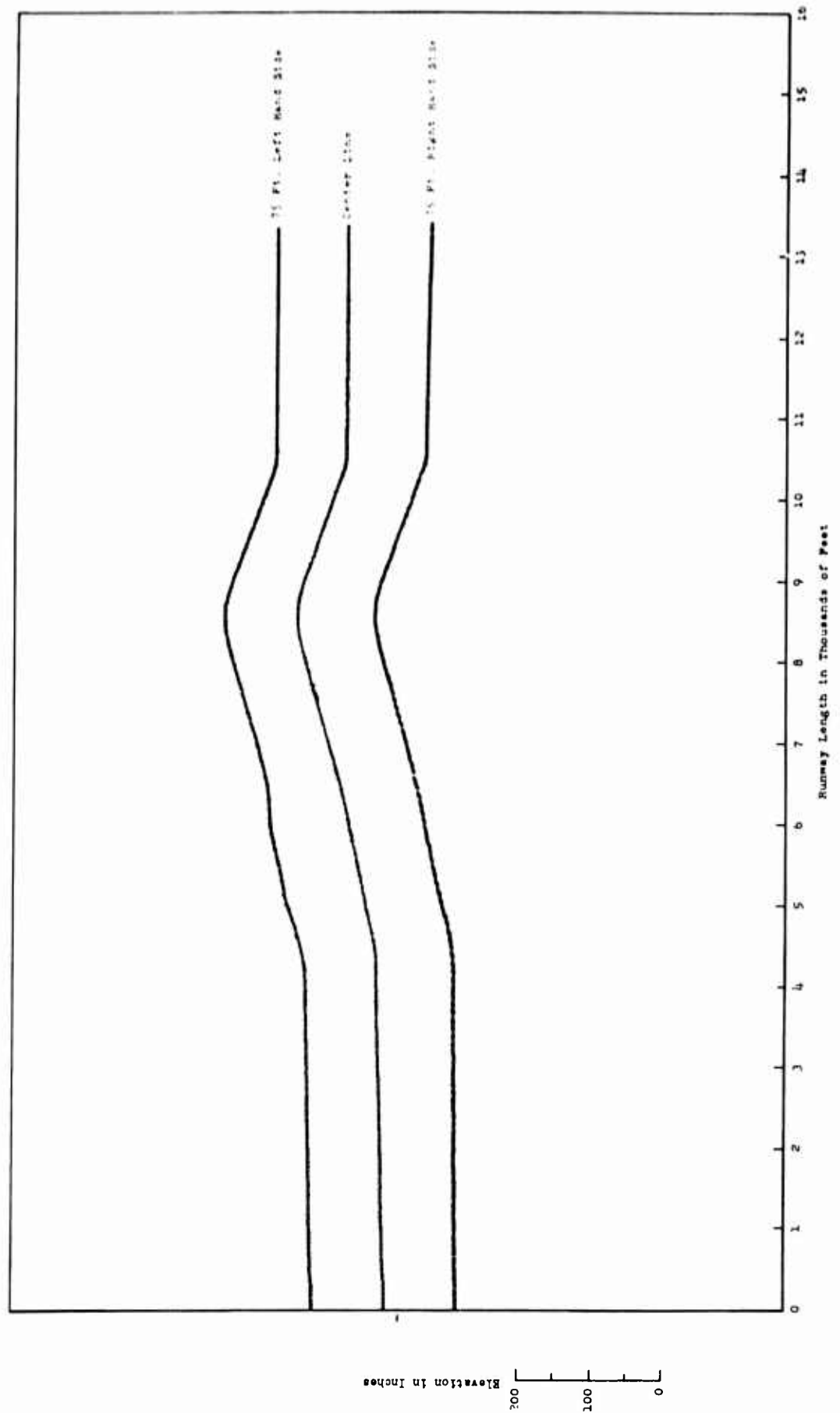


Figure 113 - Profiles, Runway 32, Larson Air Force Base

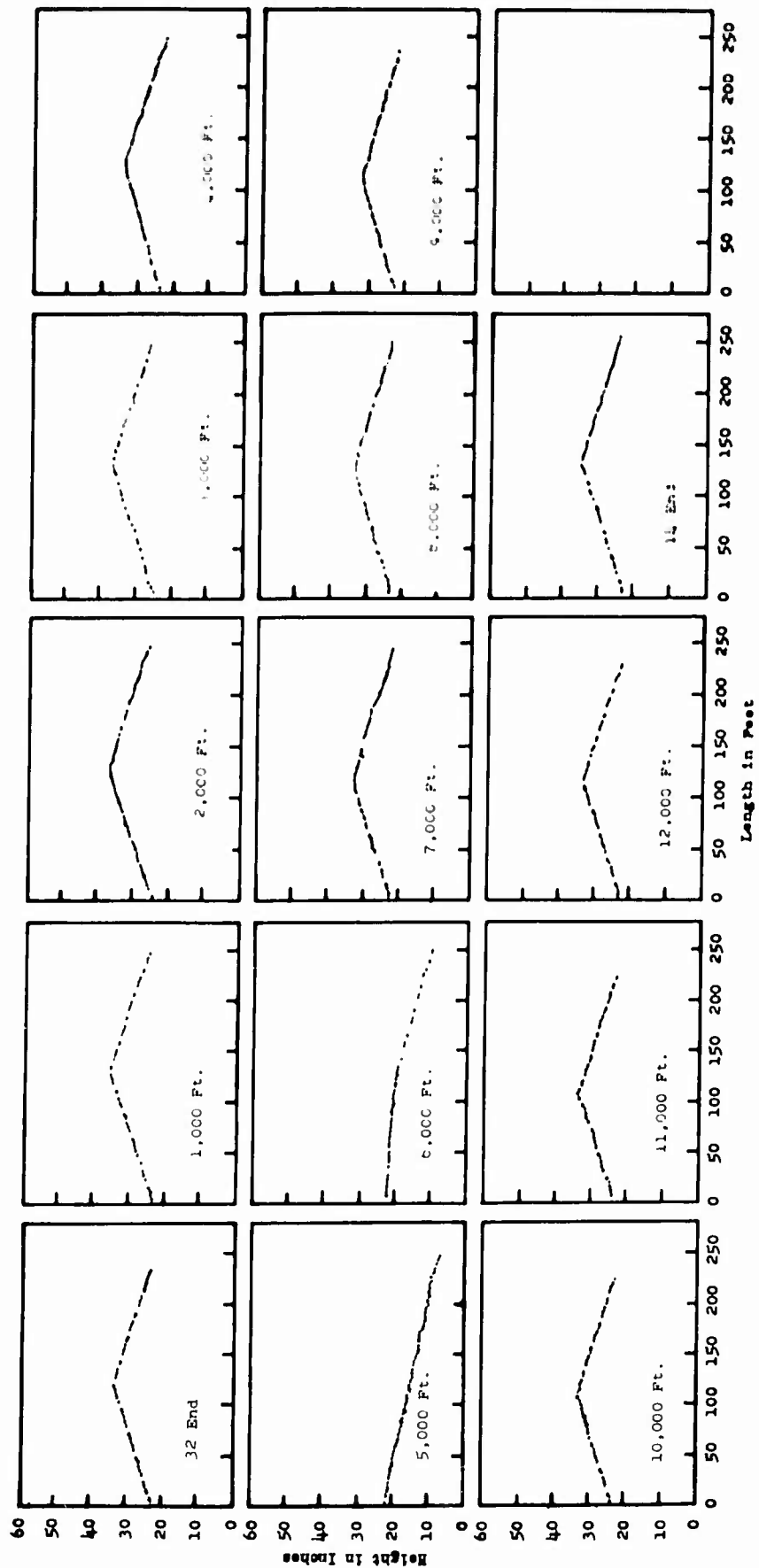


Figure 114 - Cross Run Profiles, Runway 32, Larson Air Force Base

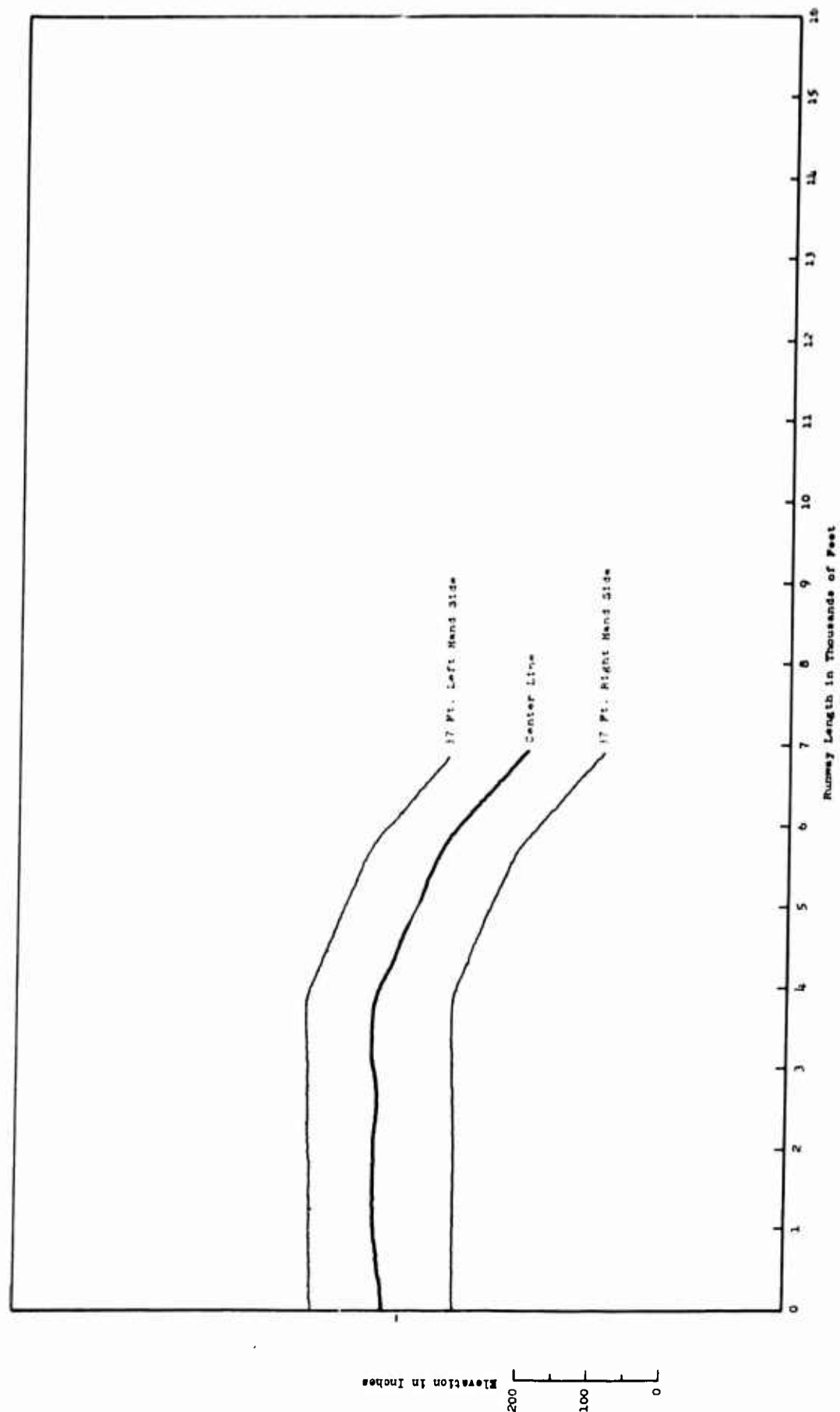


Figure 115 - Profiles, Taxiway 3, Larson Air Force Base

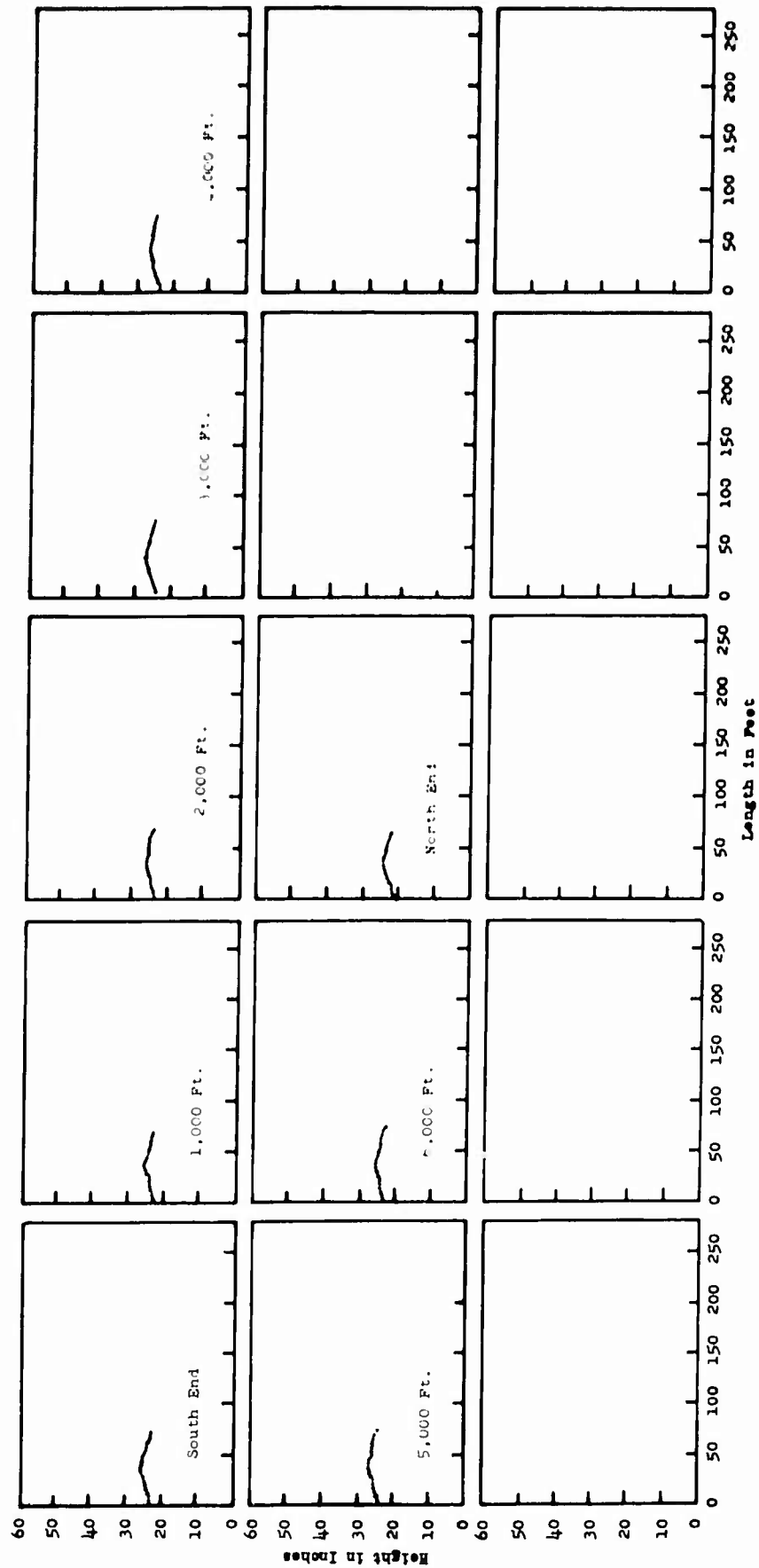


Figure 116 - Cross Run Profiles, Taxiway 3, Larson Air Force Base

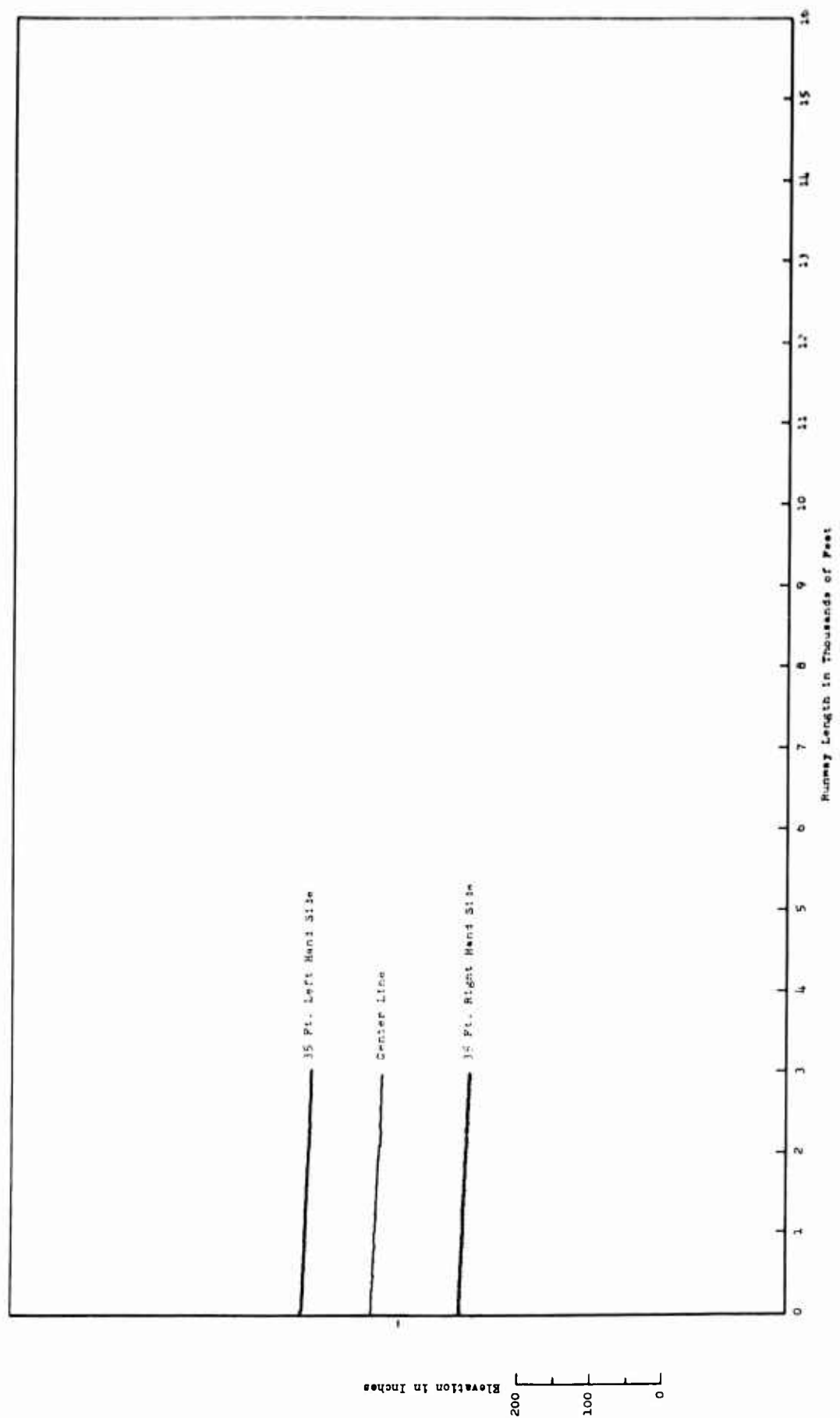


Figure 117 - Profiles, Taxiway 4, Larson Air Force Base

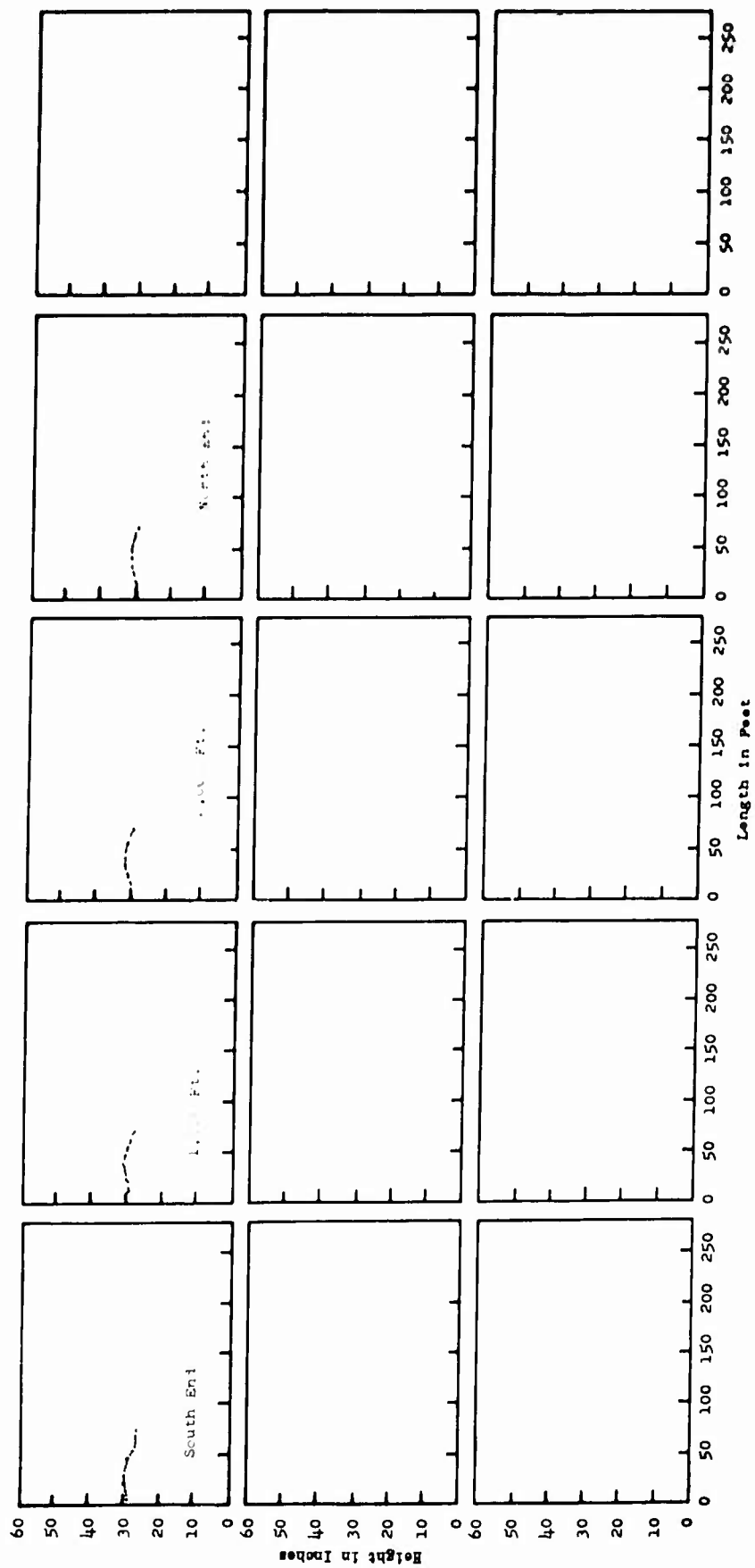


Figure 118 - Cross Run Profiles, Taxiway 4, Larson Air Force Base

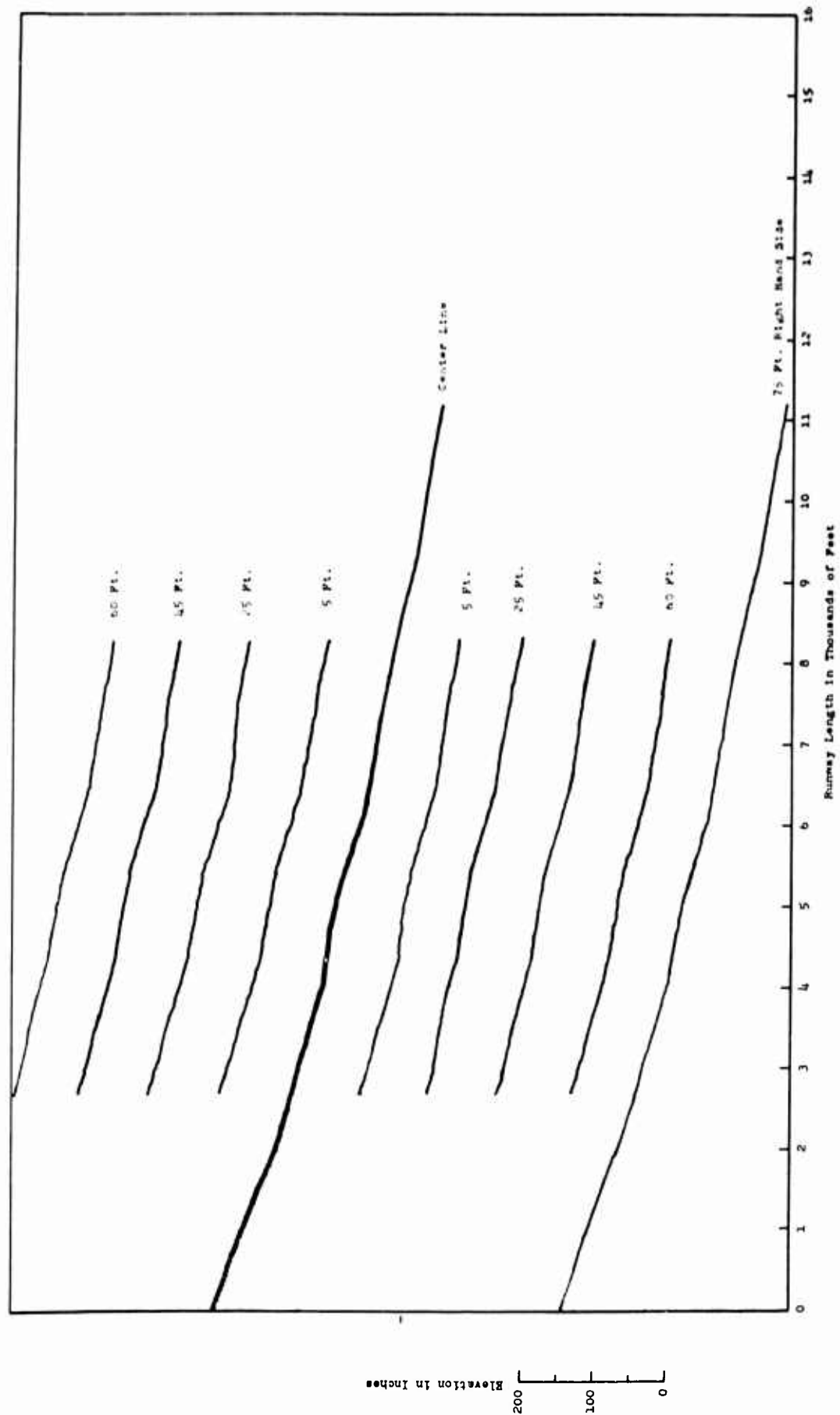


Figure 119 - Profiles, Runway 22L, Mather Air Force Base

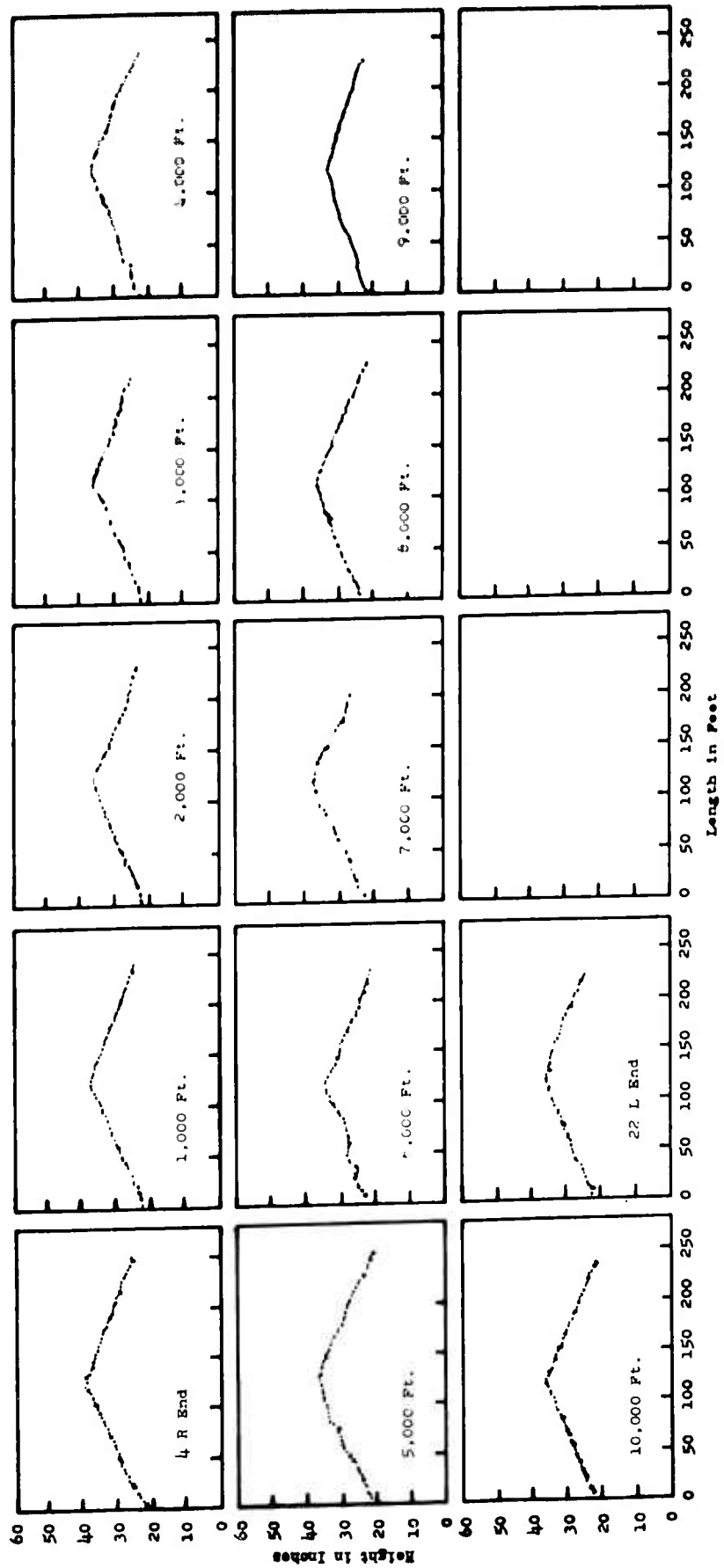


Figure 120 - Cross Run Profiles, Runway 22L, Mather Air Force Base

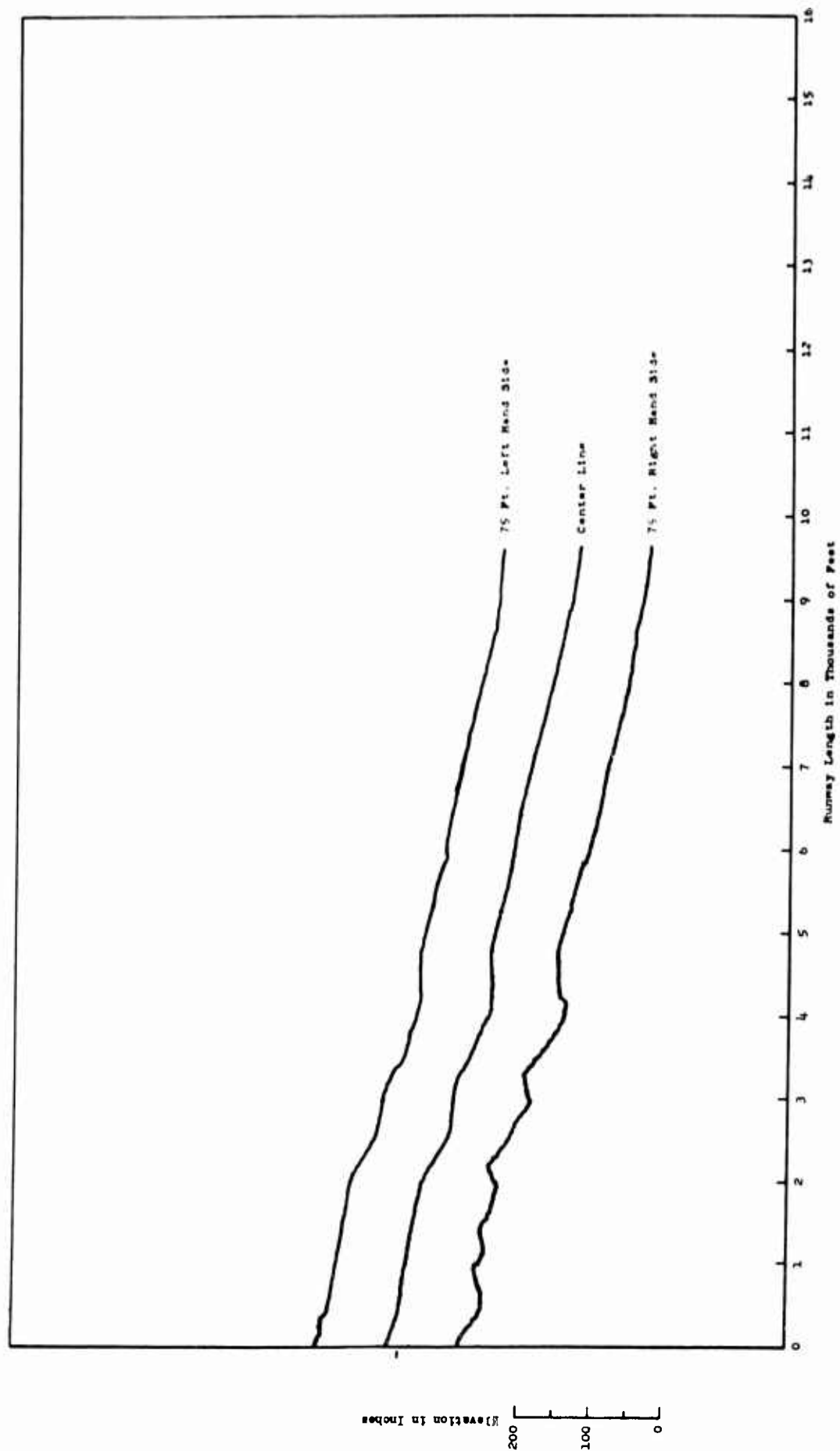


Figure 121 - Profiles, Taxiway 22, Mather Air Force Base

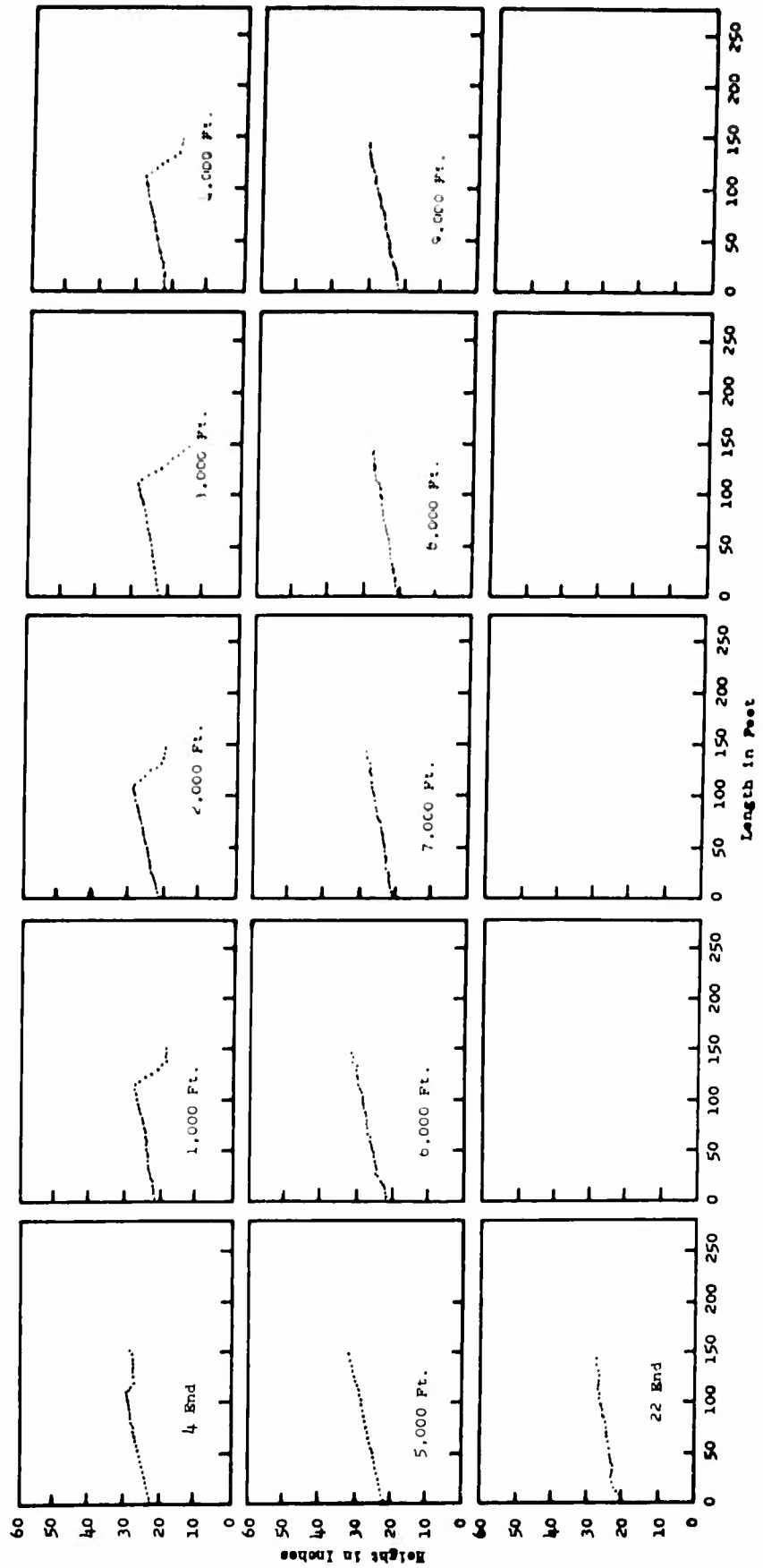


Figure 122 - Cross Run Profiles, Taxiway 22, Mather Air Force Base

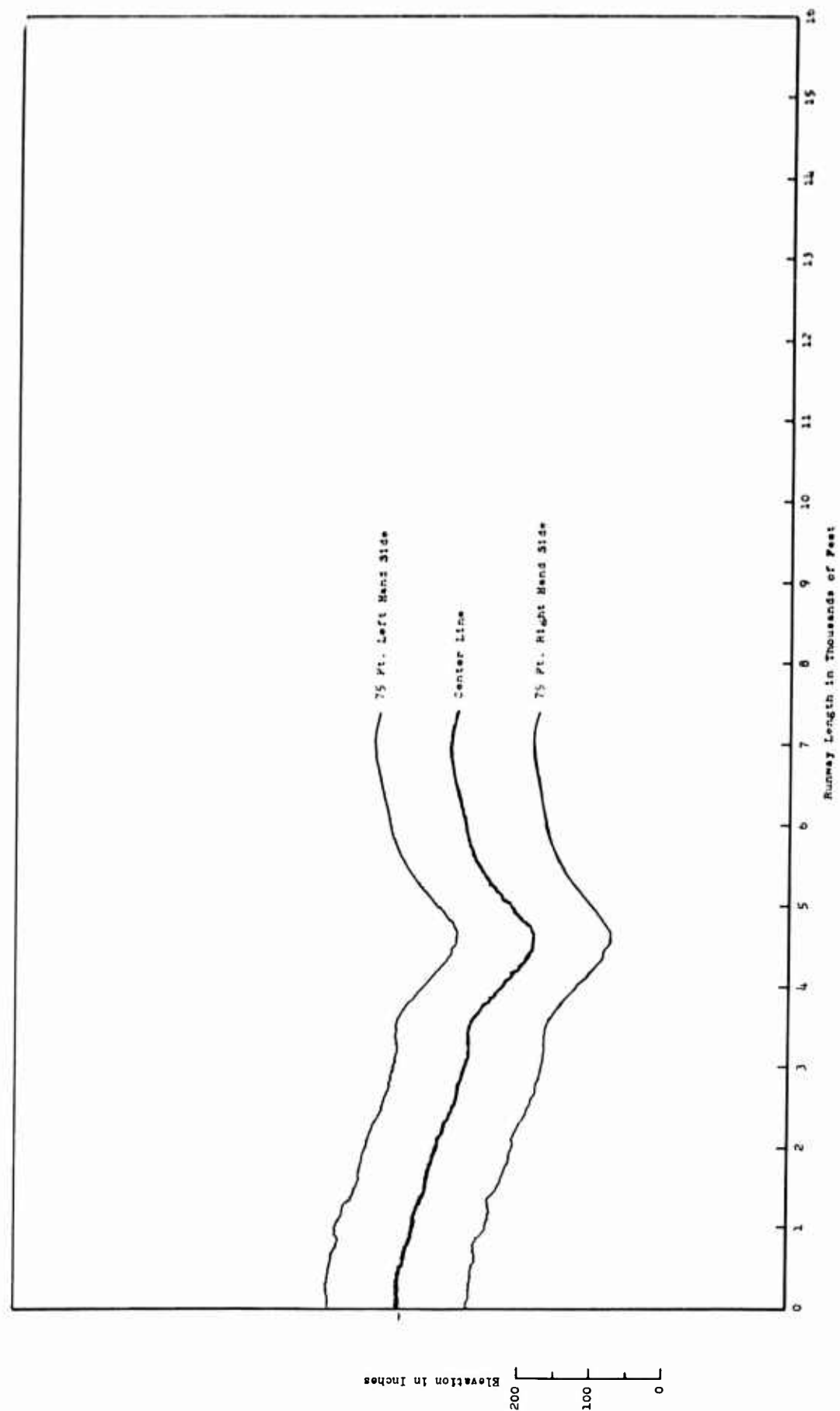


Figure 123 - Profiles, Runway 12, McGuire Air Force Base

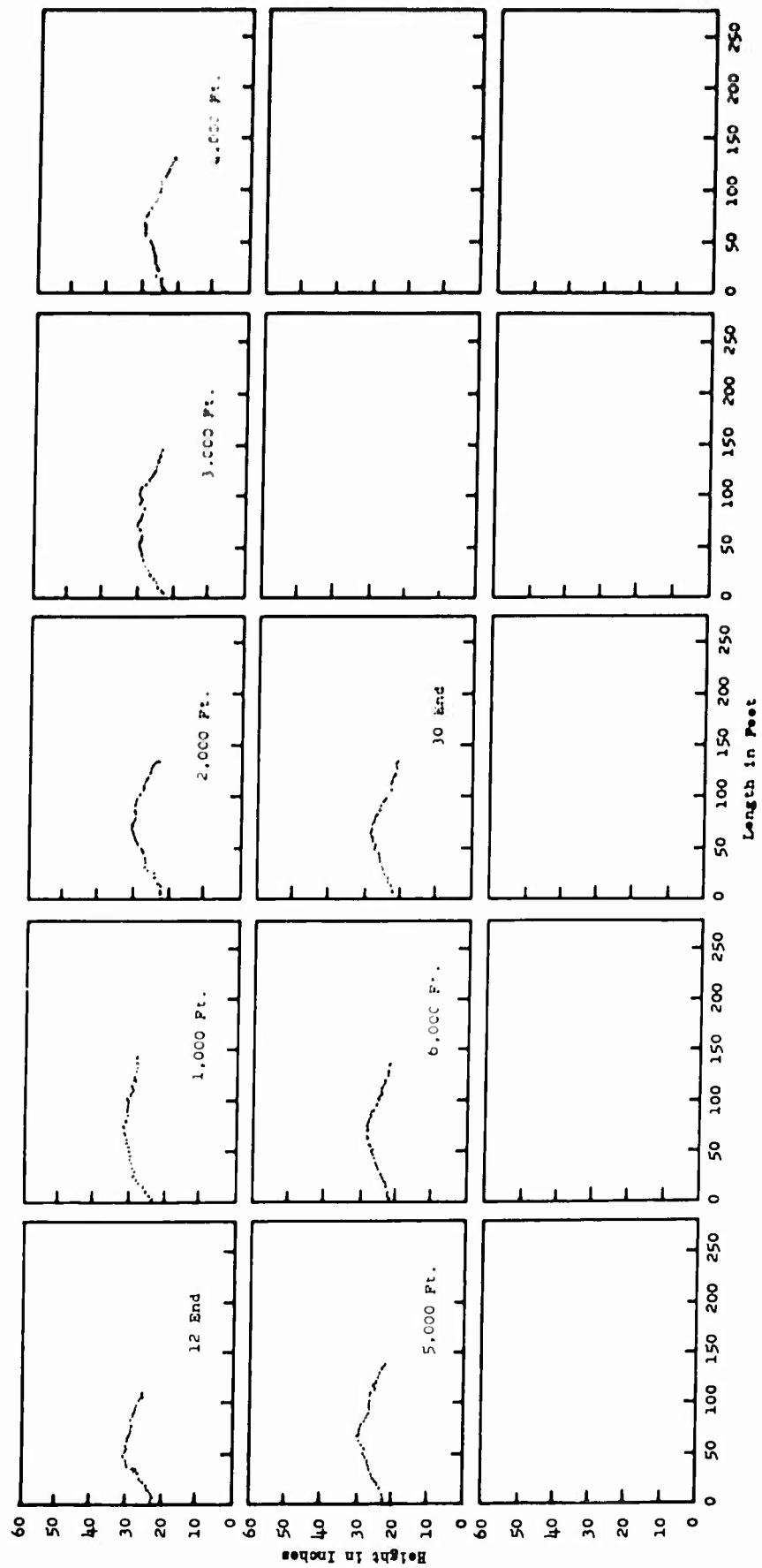


Figure 124 - Cross Run Profiles, Runway 12, McGuire Air Force Base

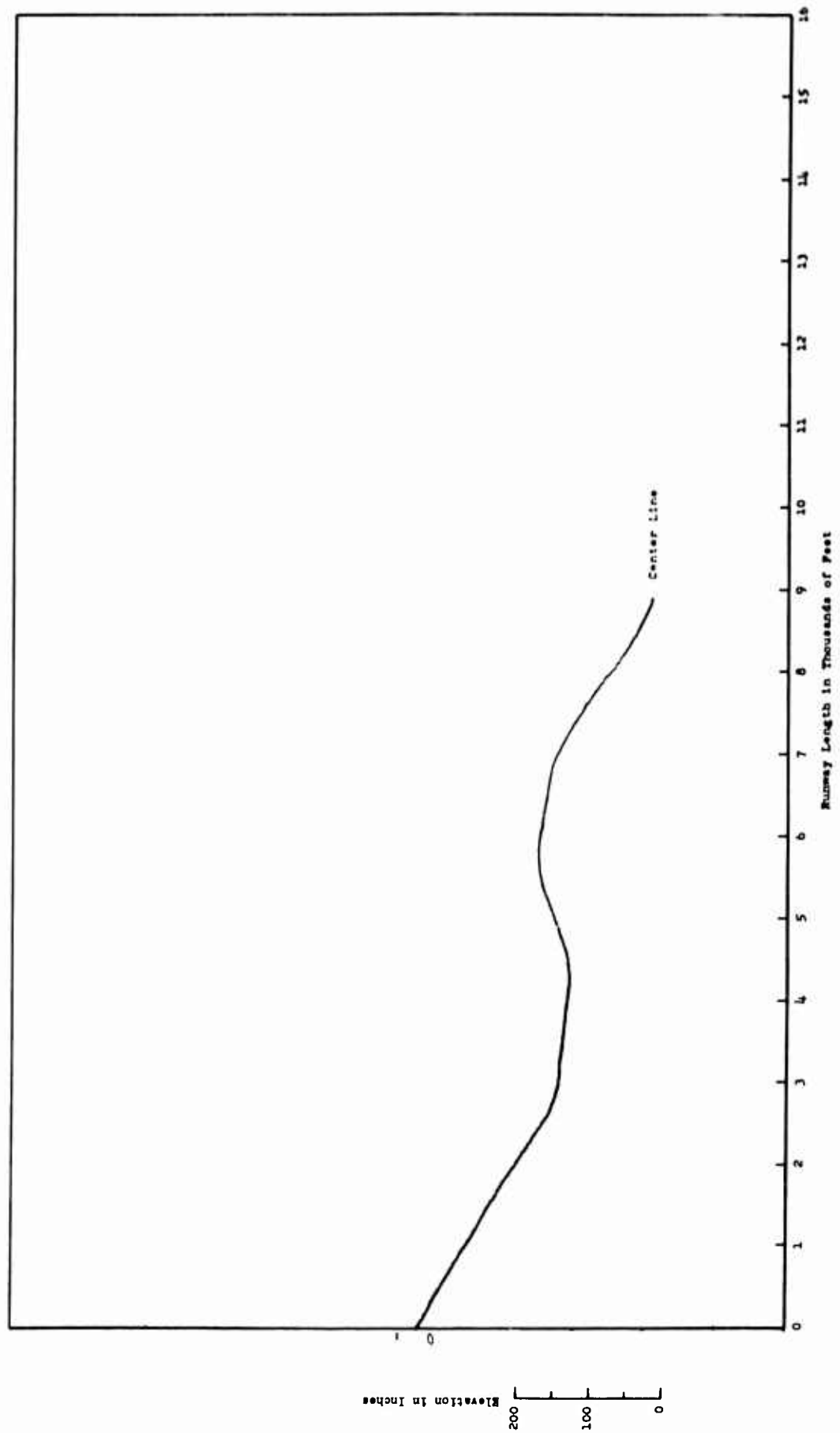


Figure 125 - Profile, Runway 6, McGuire Air Force Base

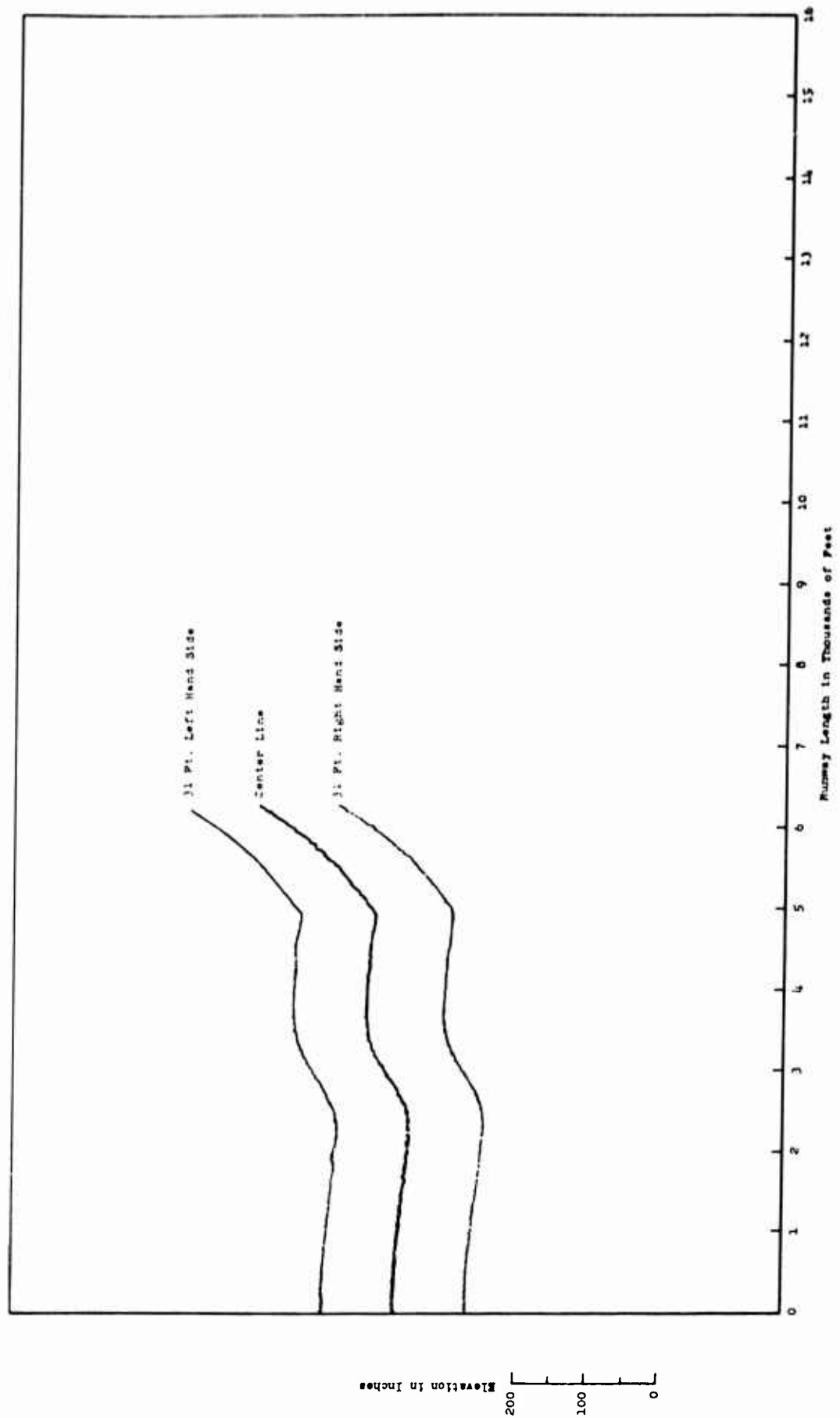


Figure 126 - Profiles, Taxiway, McGuire Air Force Base

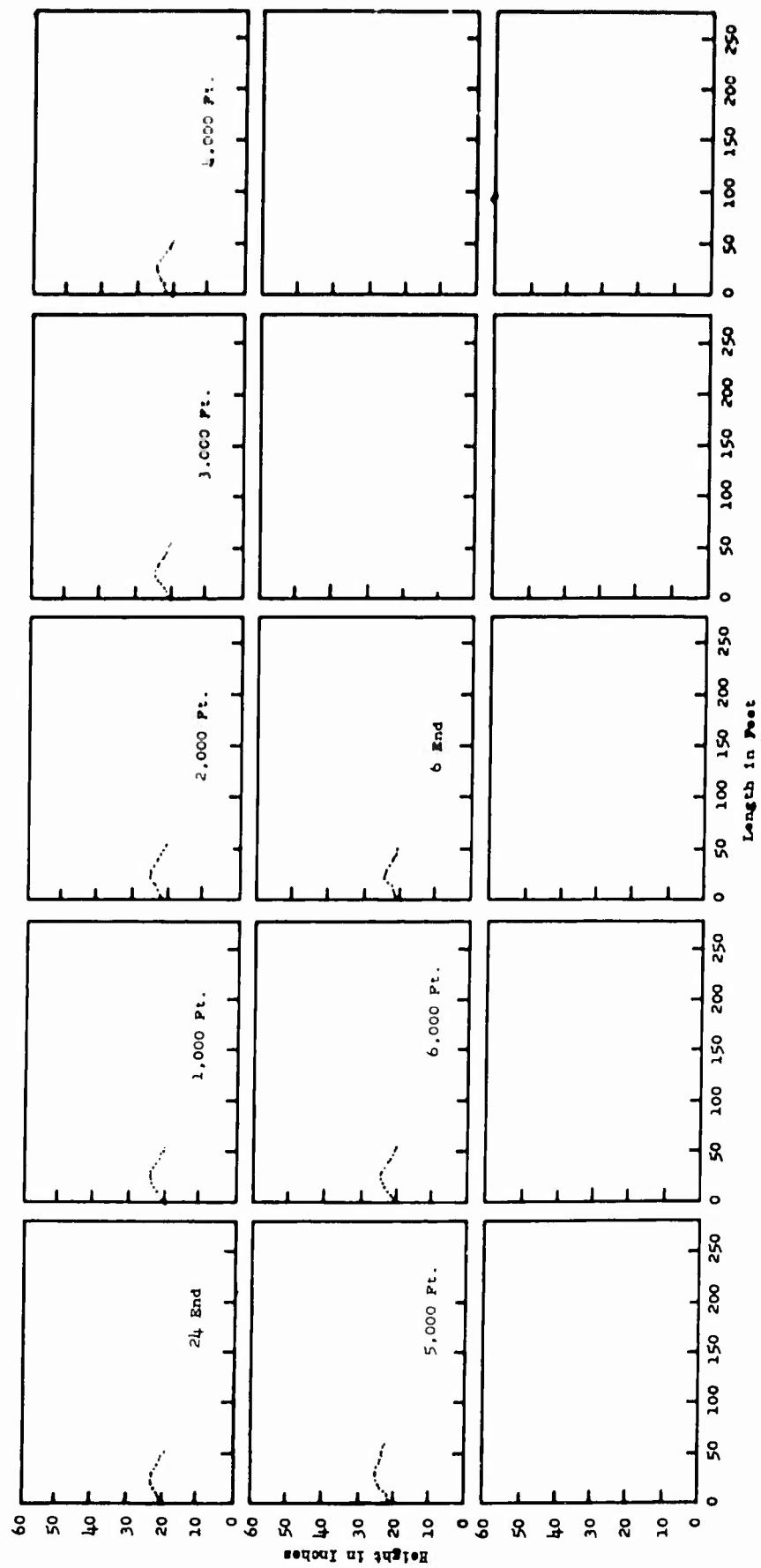


Figure 127 - Cross Run Profiles, Taxiway, McGuire Air Force Base

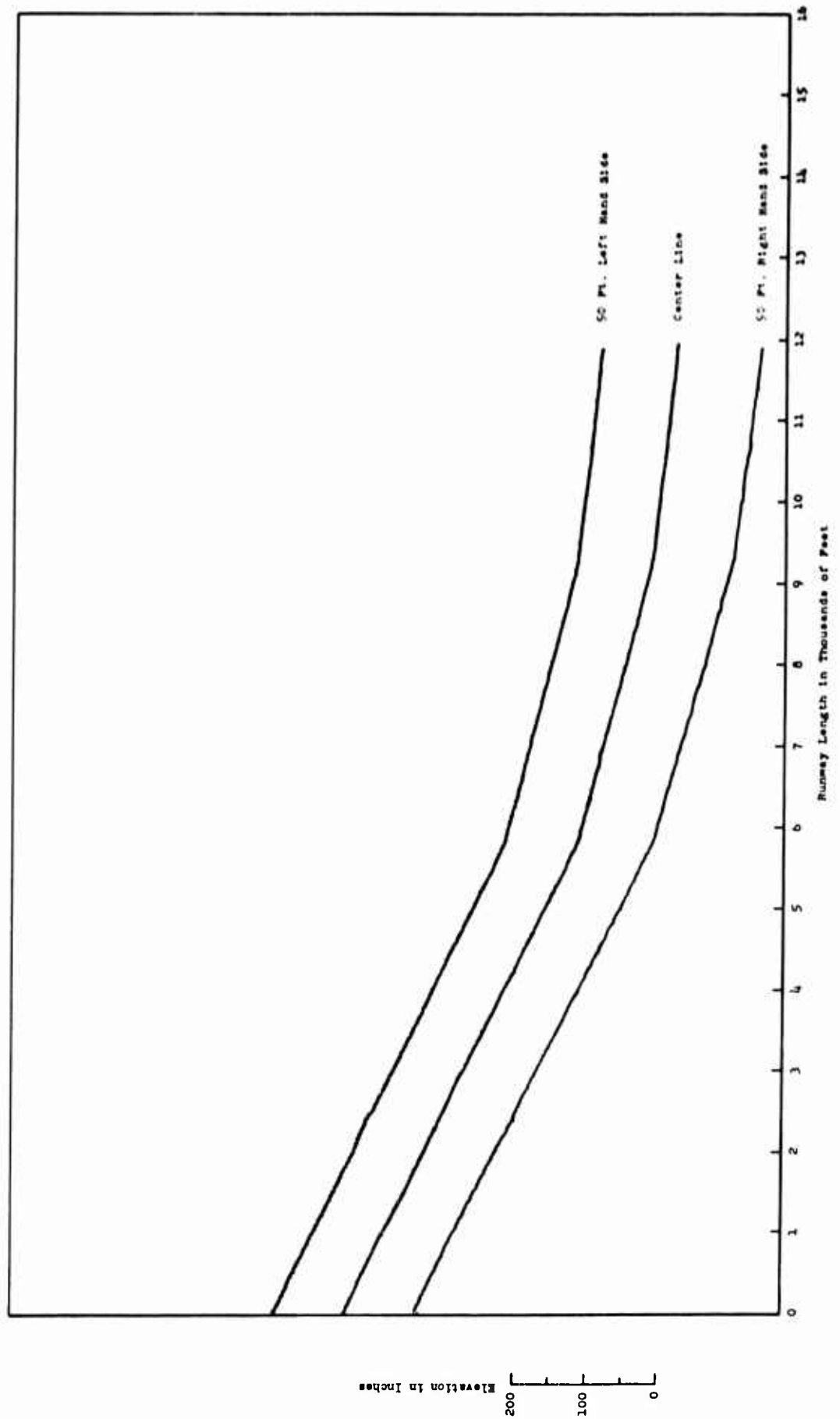


Figure 128 - Profiles, Runway 7, Palmdale Air Force Plant MR42

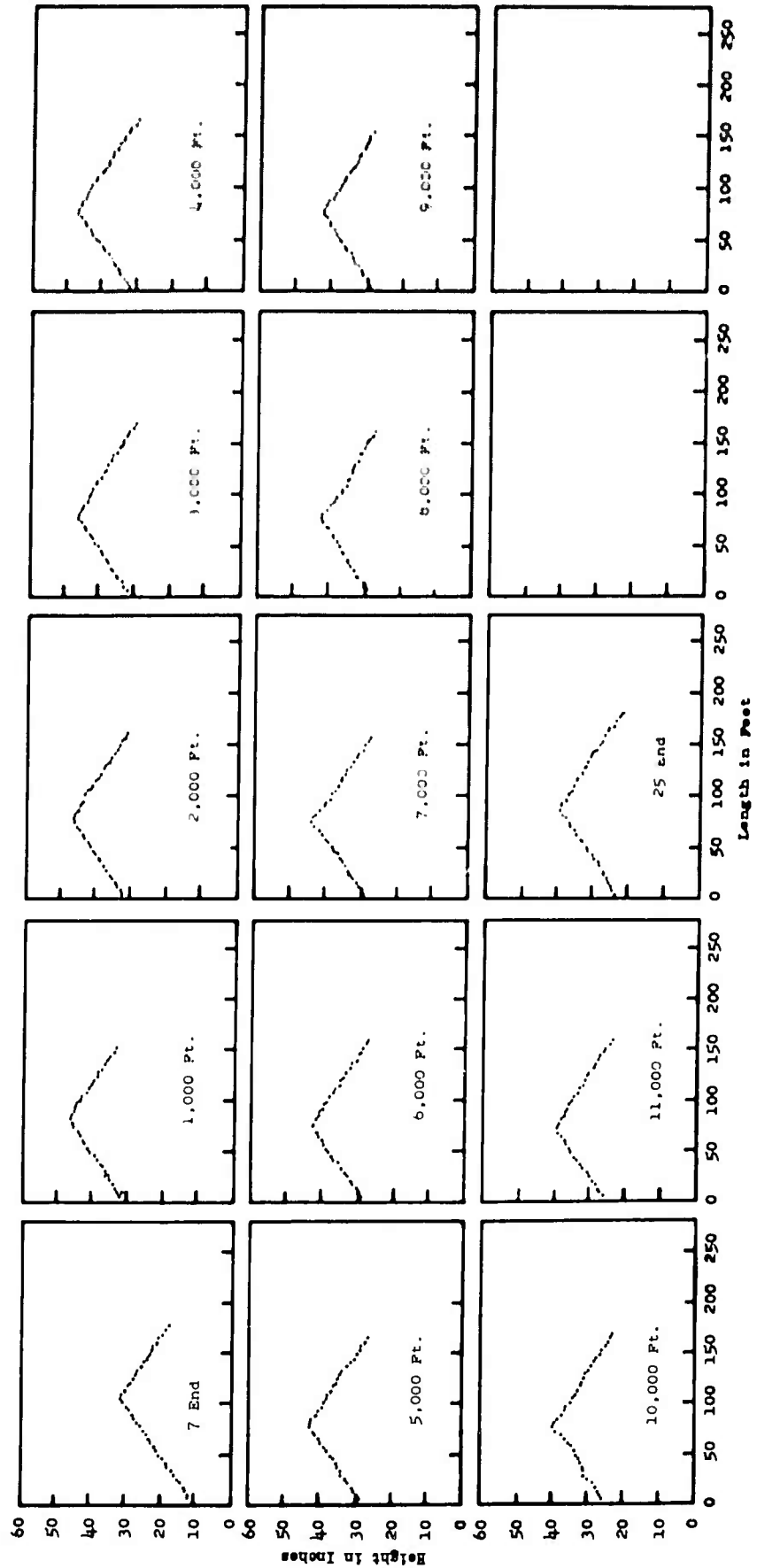


Figure 129 - Cross Run Profiles, Runway 7, Palmdale Air Force Plant NR42

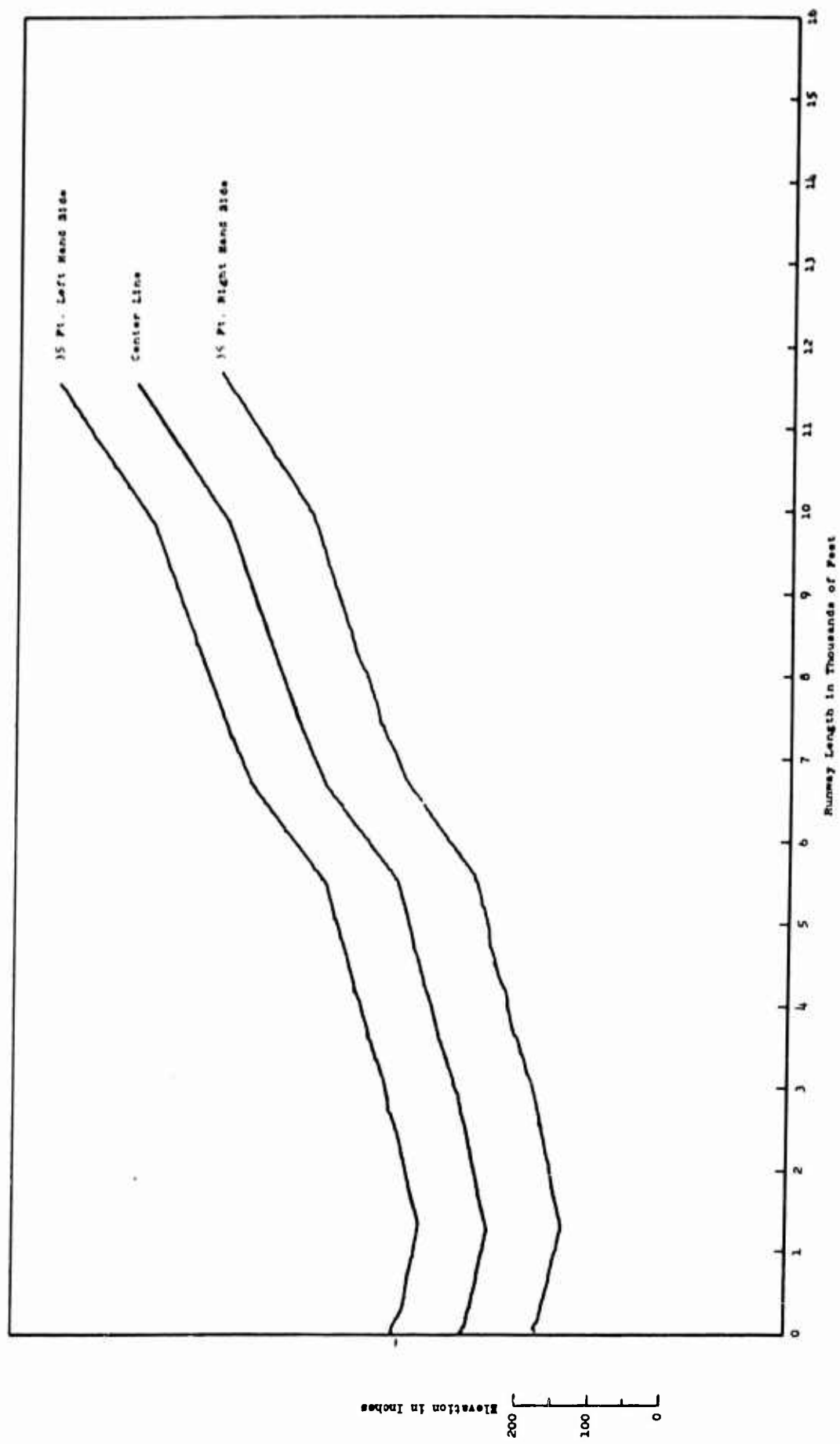


Figure 130 - Profiles, Taxiway B, Palmdale Air Force Plant NR42

Elevation in Inches
200
100
0

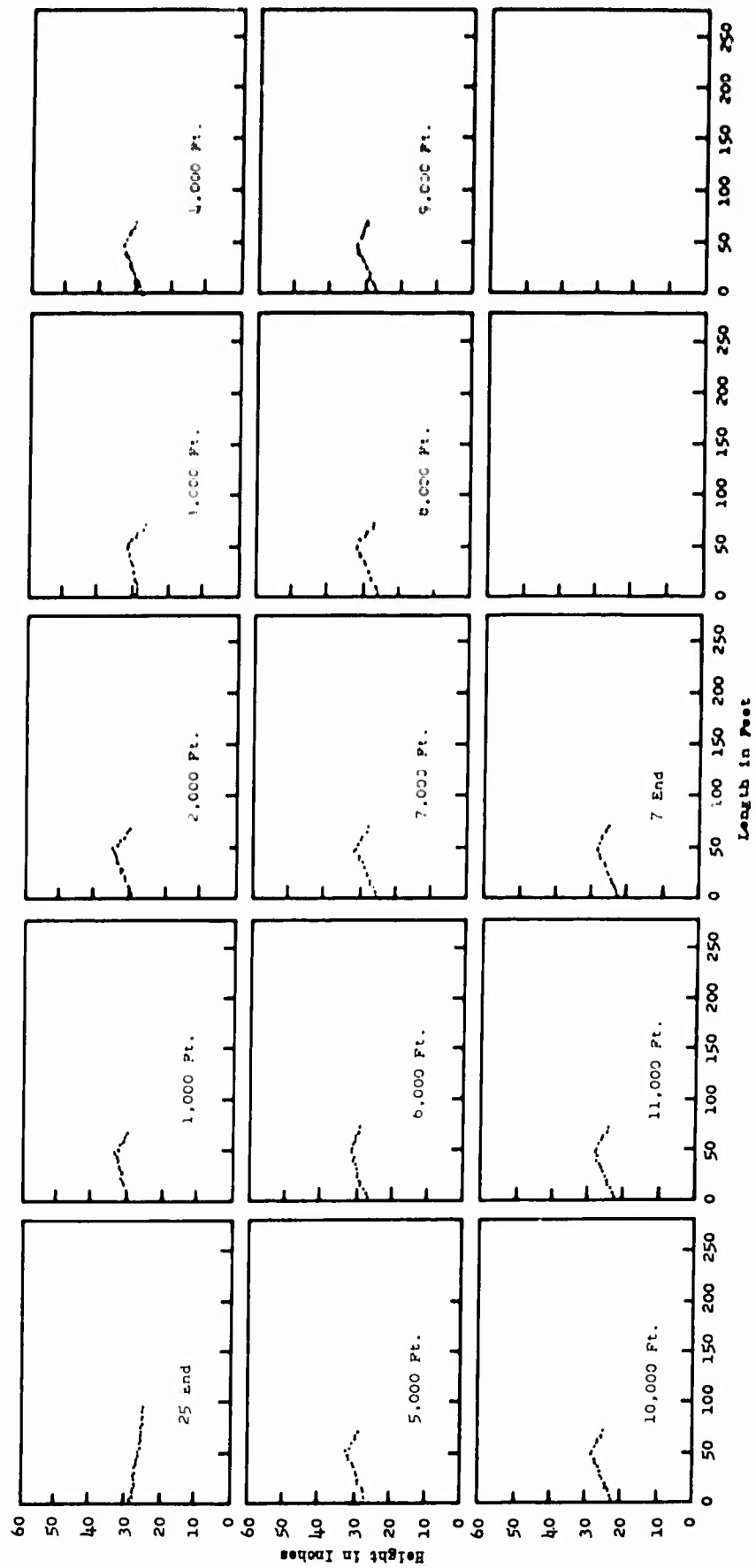


Figure 131 - Cross Run Profiles, Taxiway B, Palmdale Air Force Plant NR42

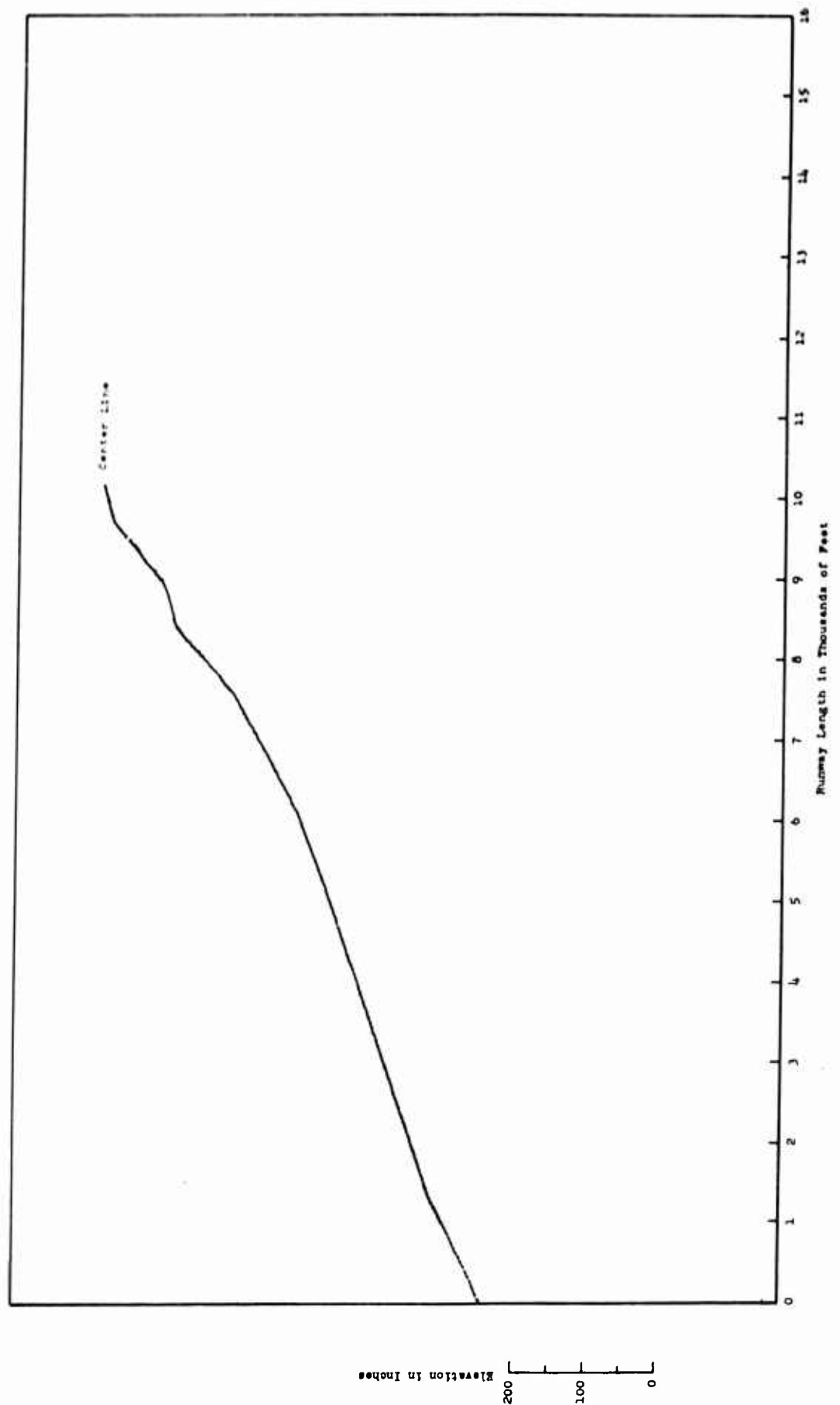


Figure 132 - Profile, Taxiway E, Palmdale Air Force Plant NR42

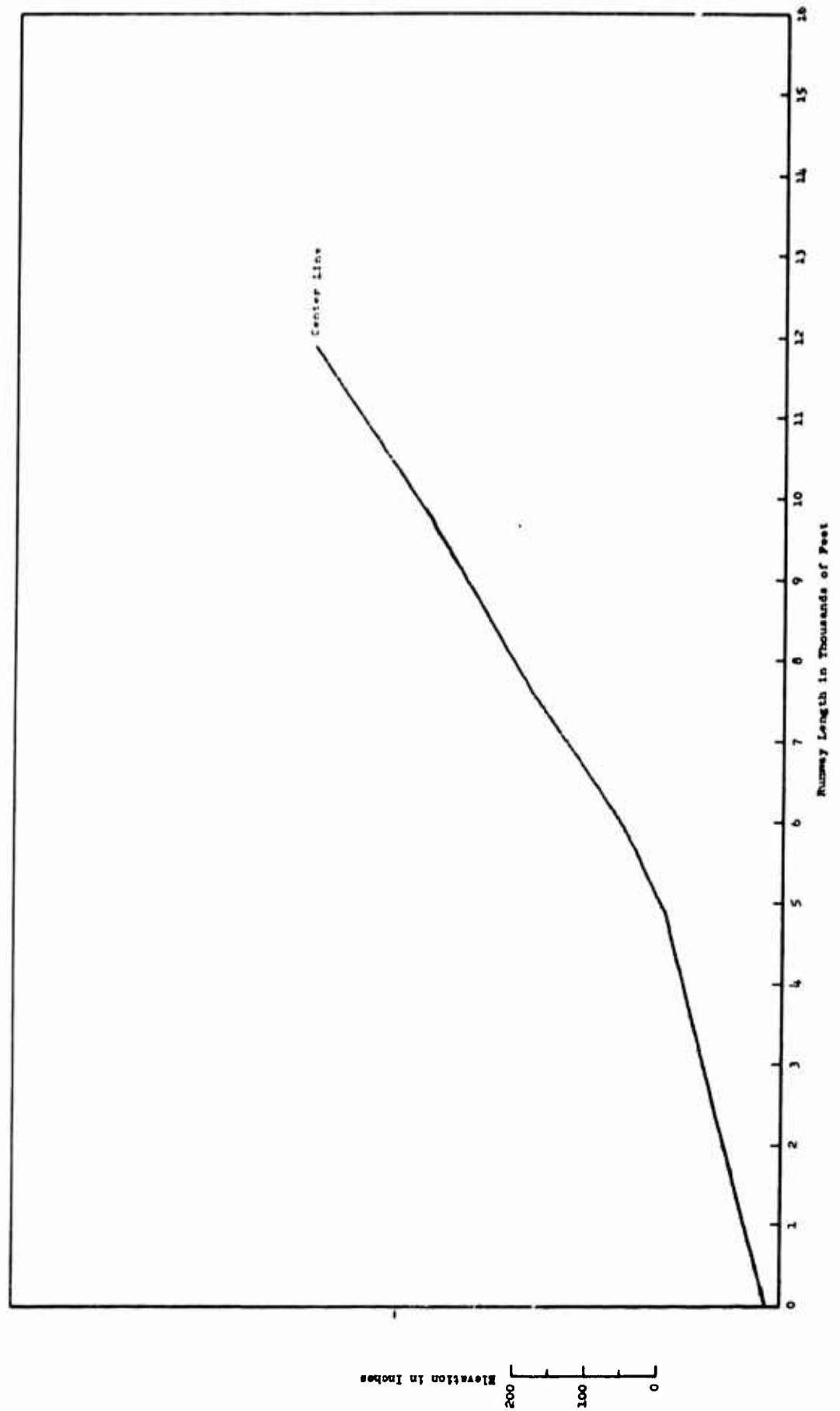


Figure 133 - Profile, Runway 22, Palmdale Air Force Plant NR42

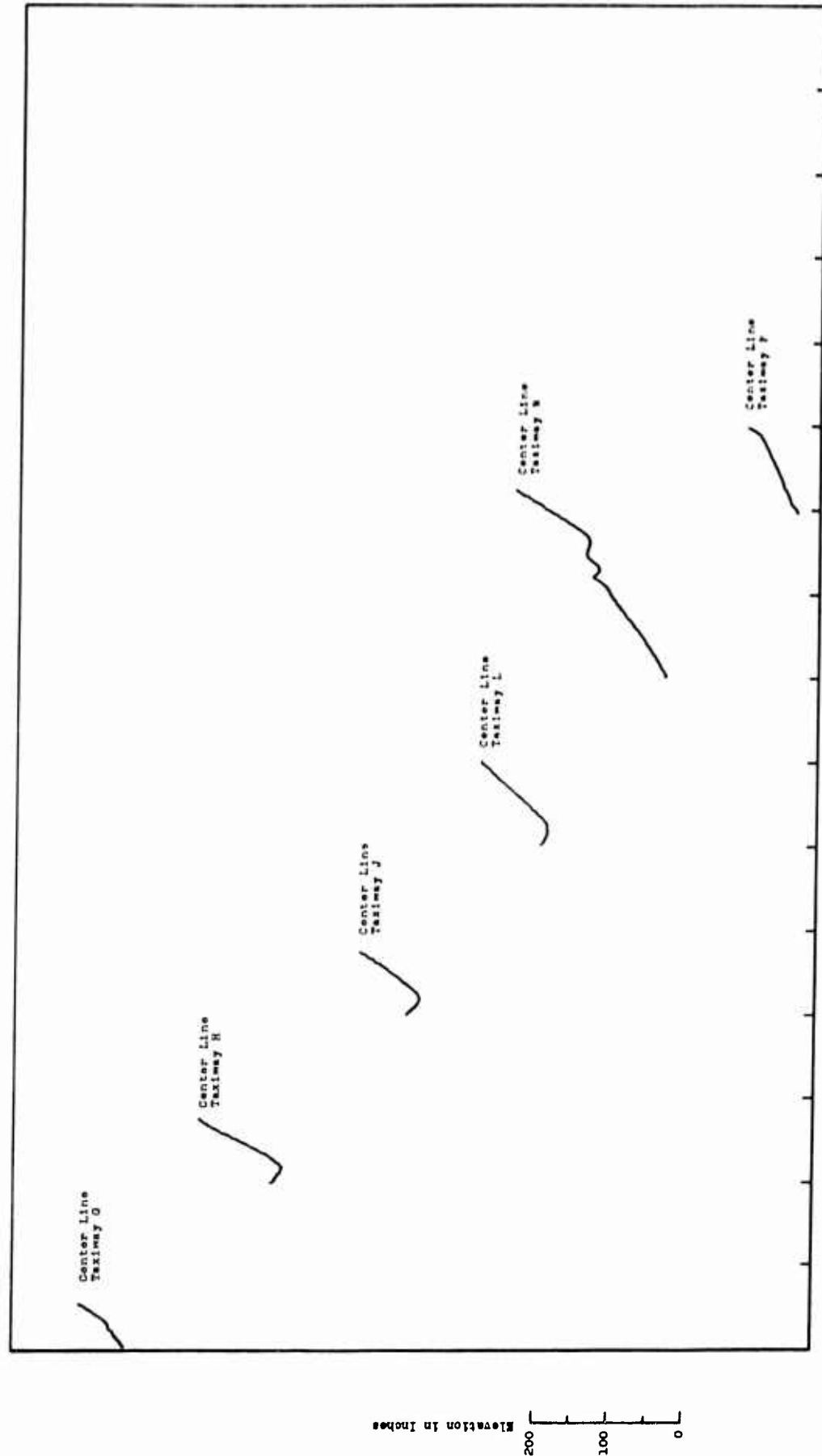


Figure 134 - Profiles, Taxiways, Palmdale Air Force Plant NR42

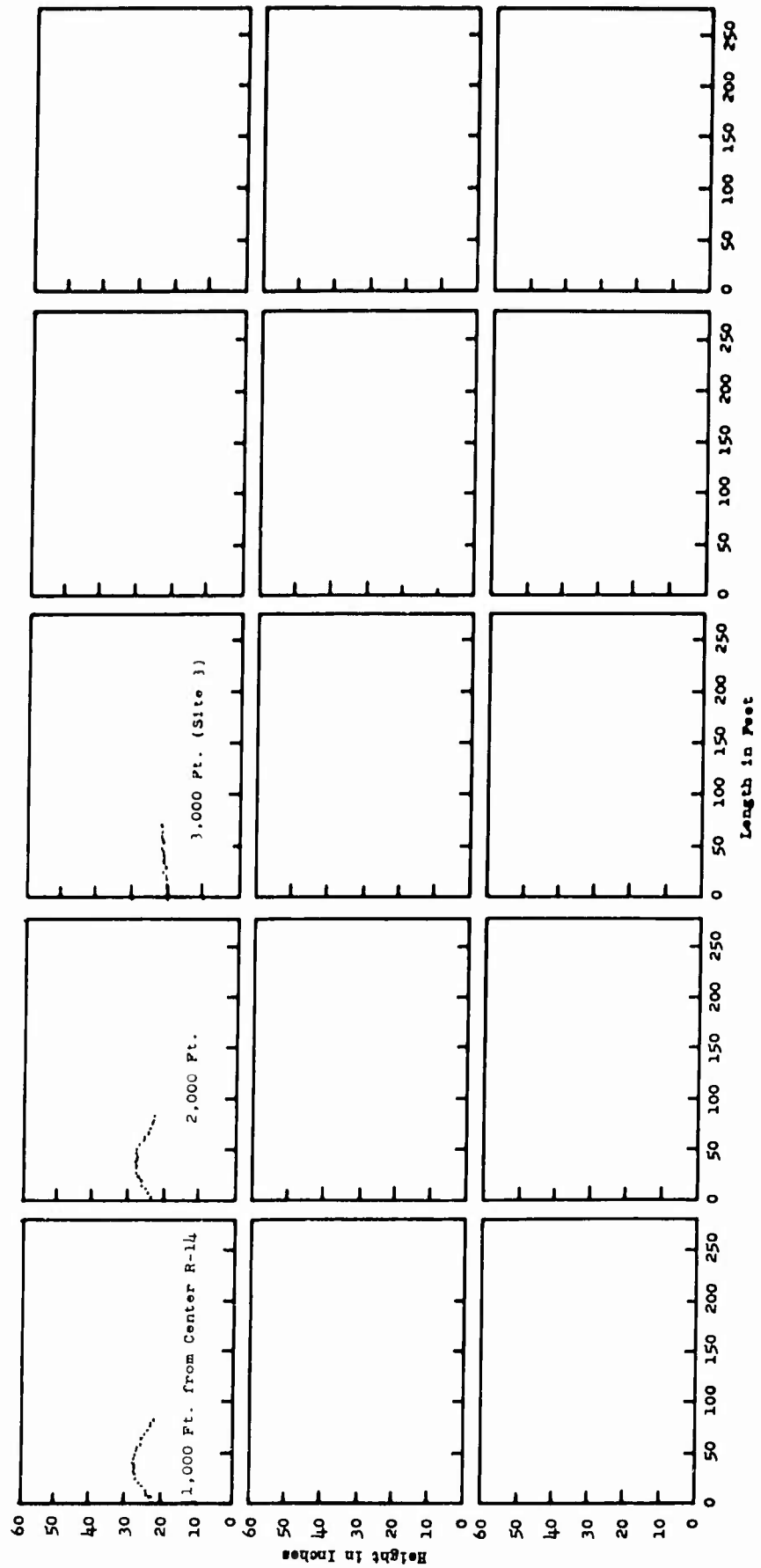


Figure 135 - Cross Run Profiles, Taxiway N, Palmdale Air Force Plant NR42

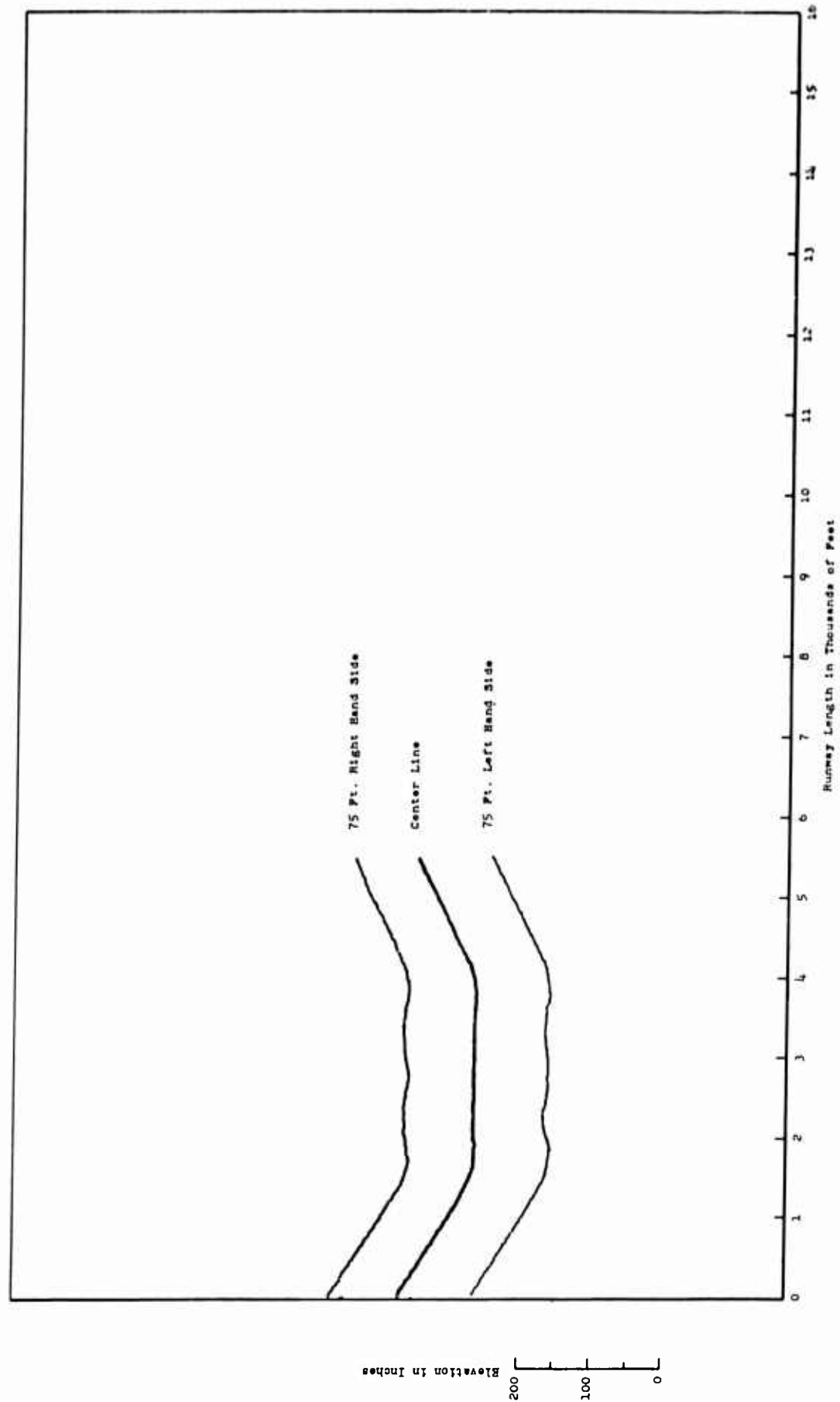


Figure 136 - Profiles, Runway 18, Stewart Air Force Base

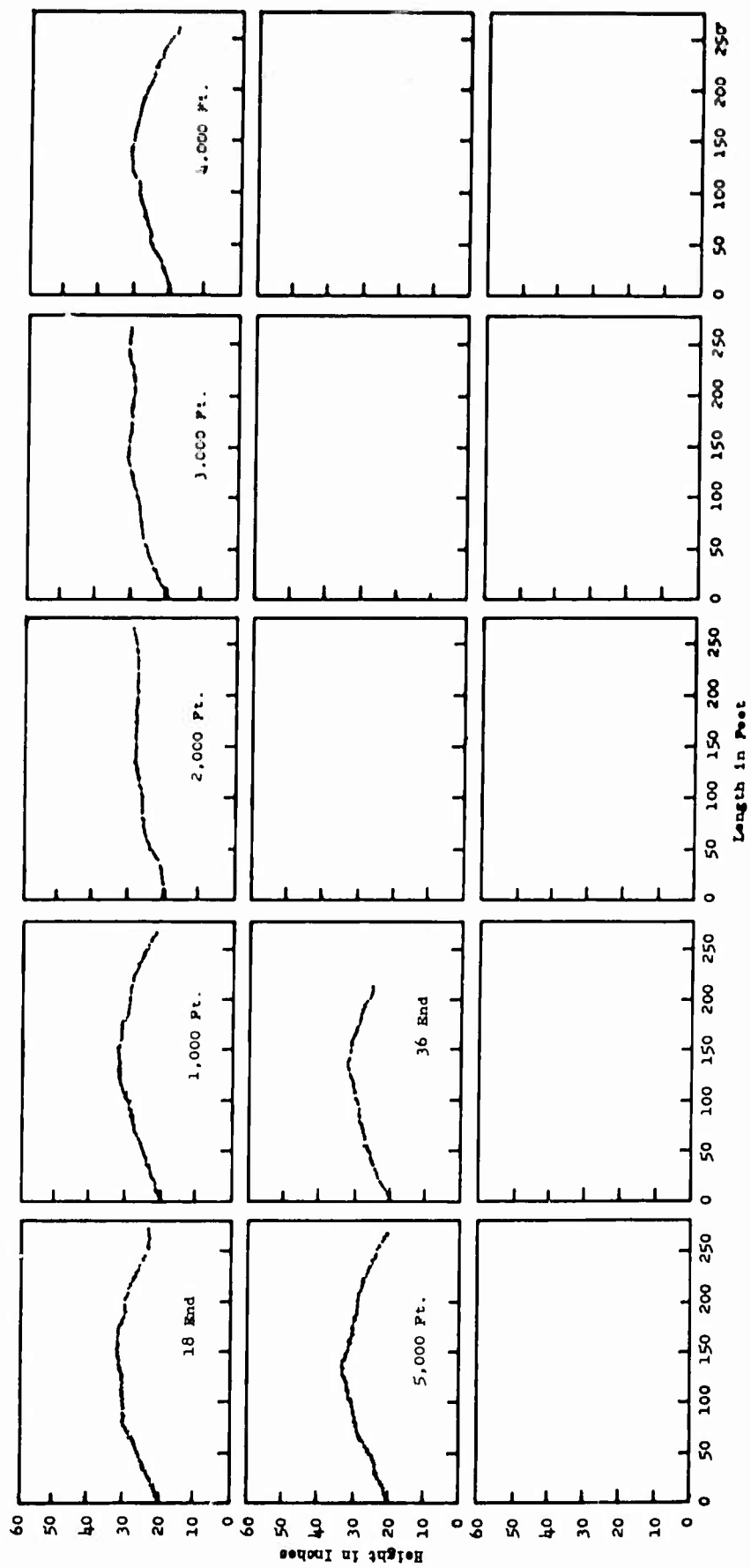


Figure 137 - Cross Run Profiles, Runway 18, Severt Air Force Base

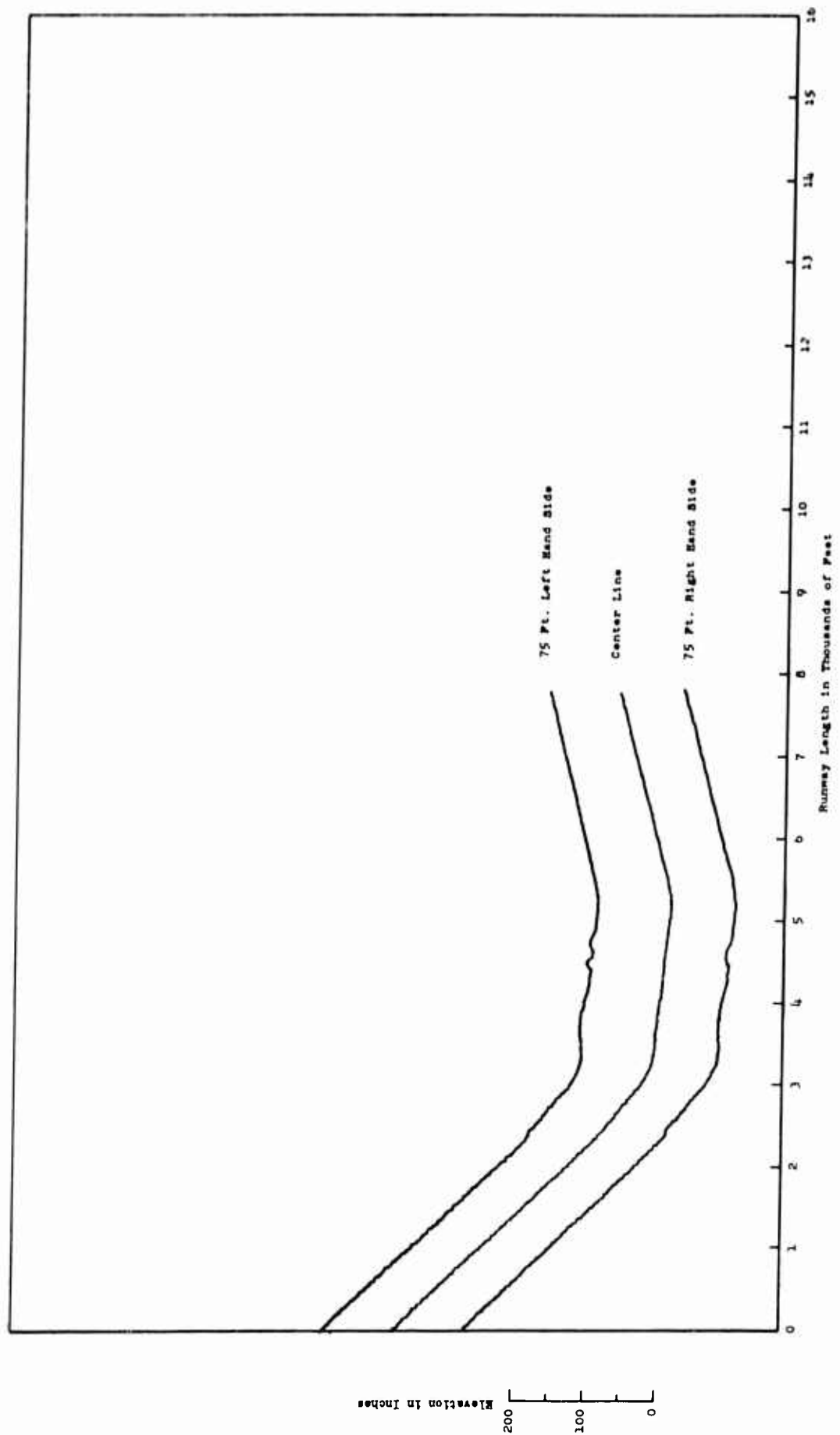


Figure 138 - Profiles, Runway 14, Severt Air Force Base

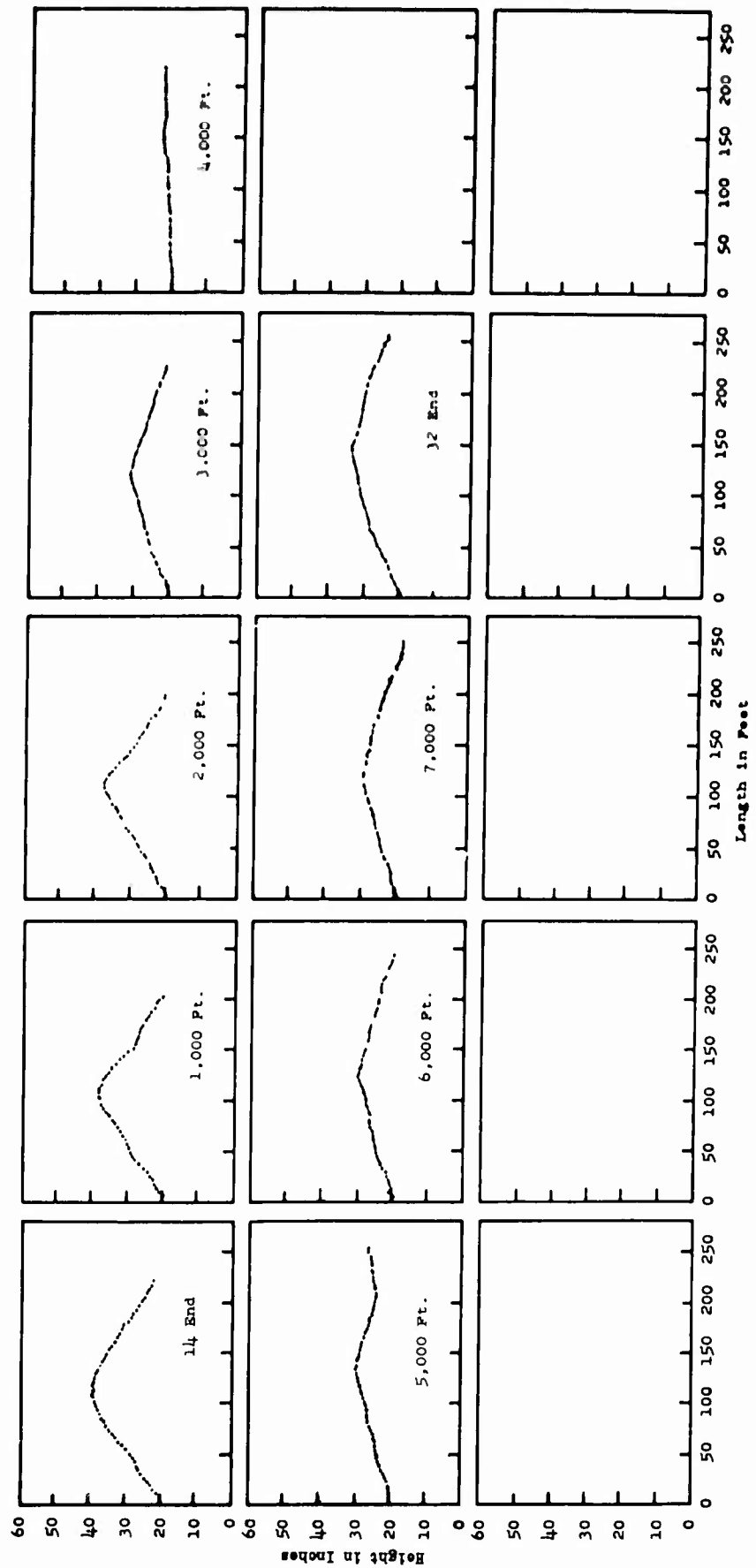


Figure 139 - Cross Run Profiles, Runway 14, Severt Air Force Base

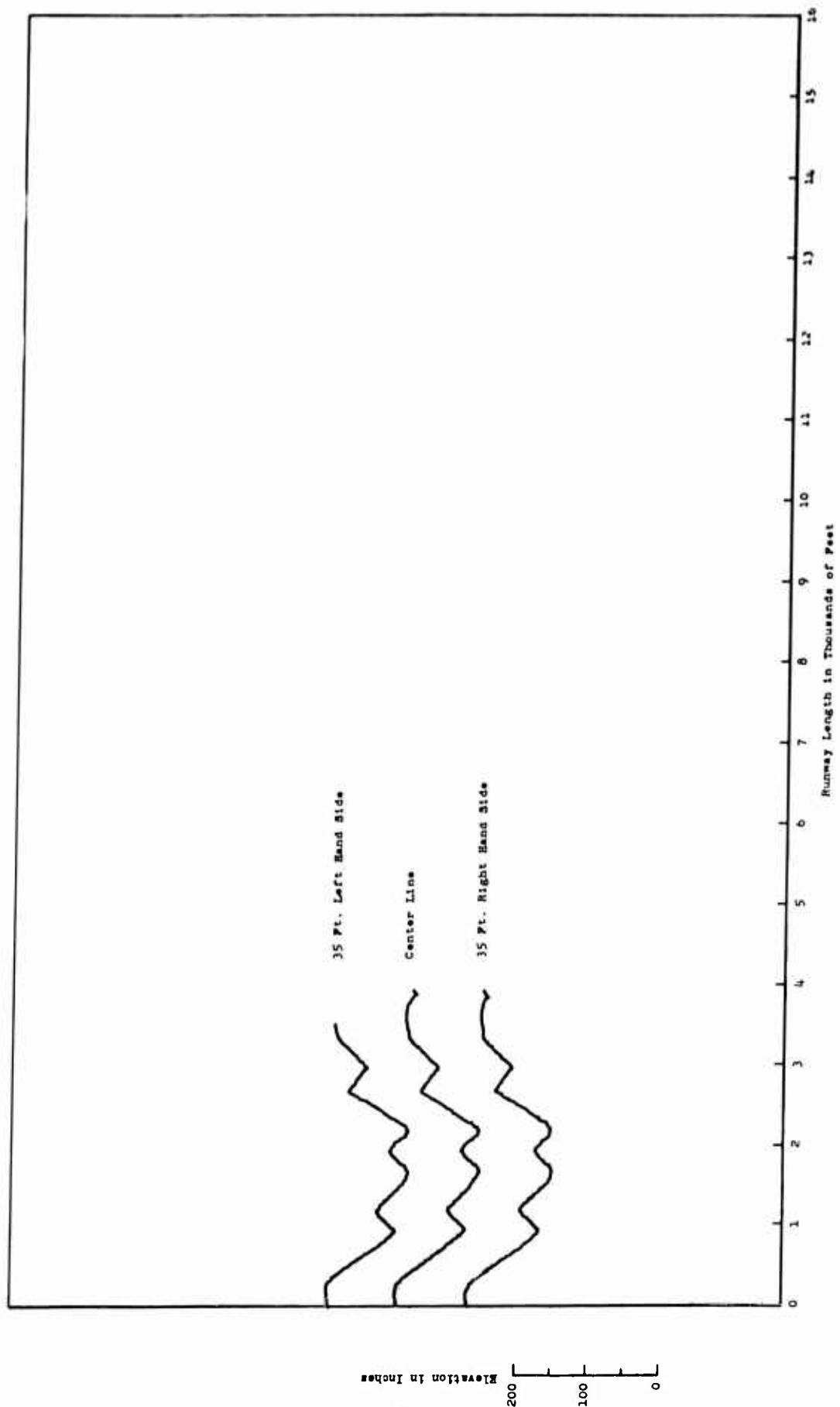


Figure 140 - Profiles, Taxiway 2, Sewart Air Force Base

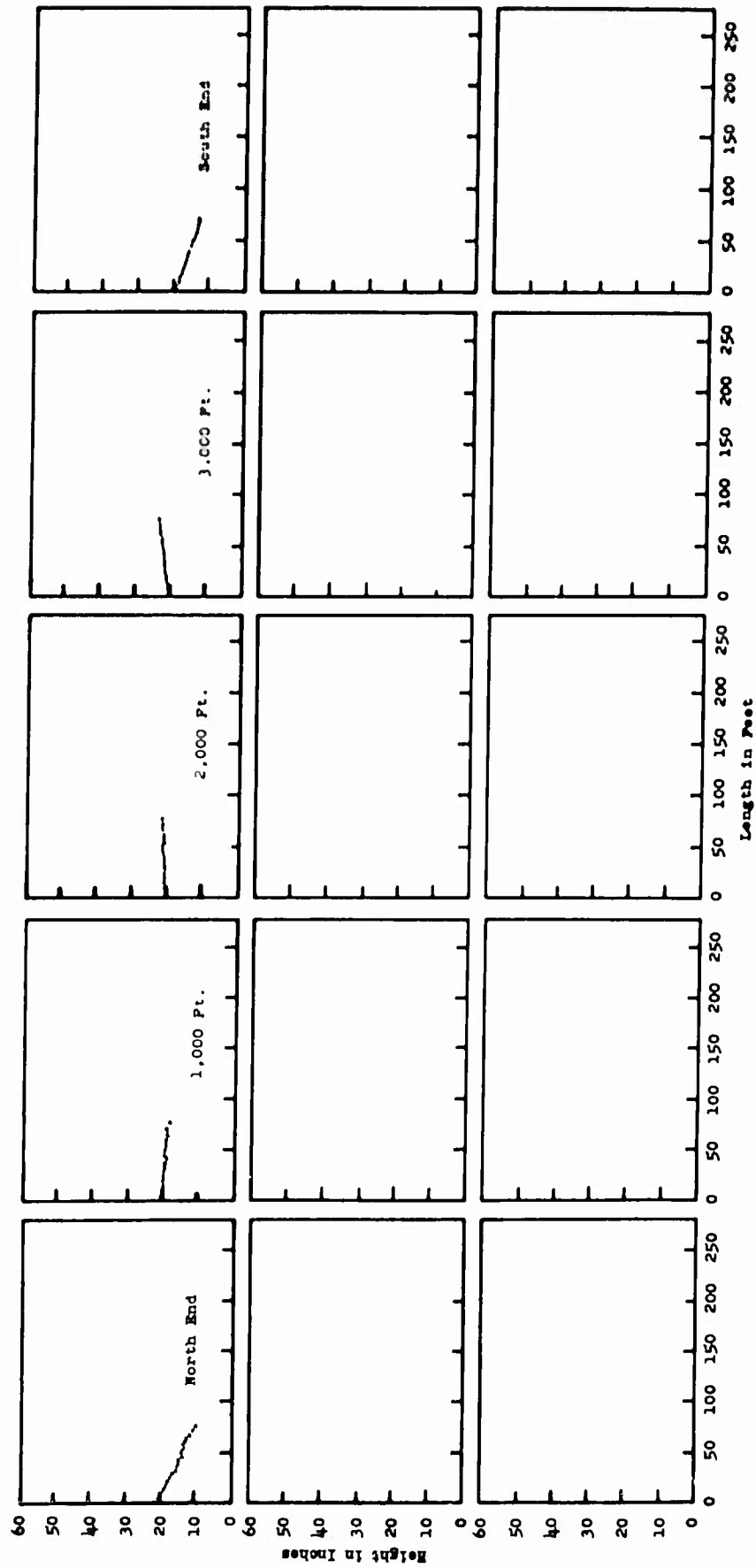


Figure 141 - Cross Run Profile, Taxiway 2, Sewart Air Force Base

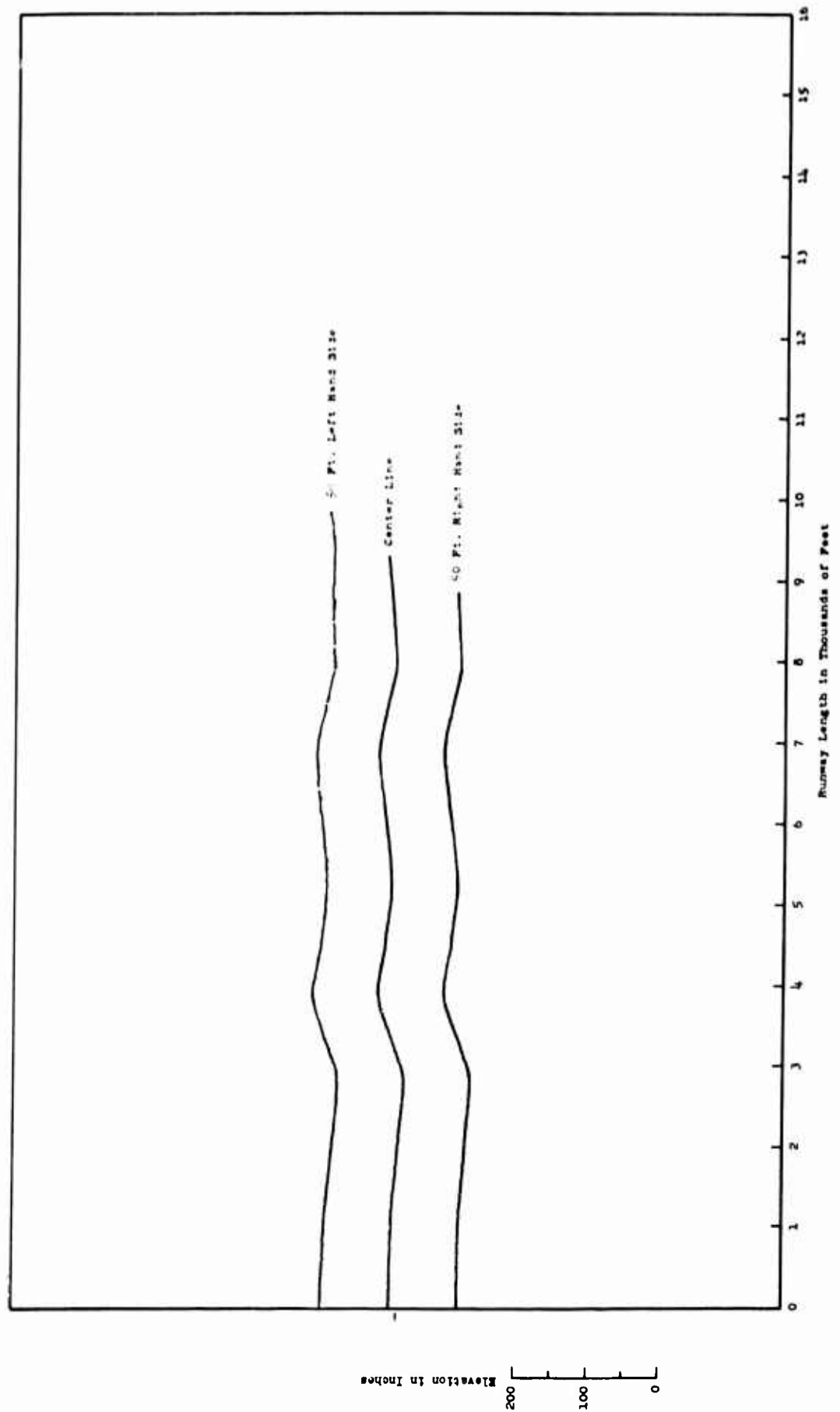


Figure 142 - Profiles, Runway 4, Shaw Air Force Base

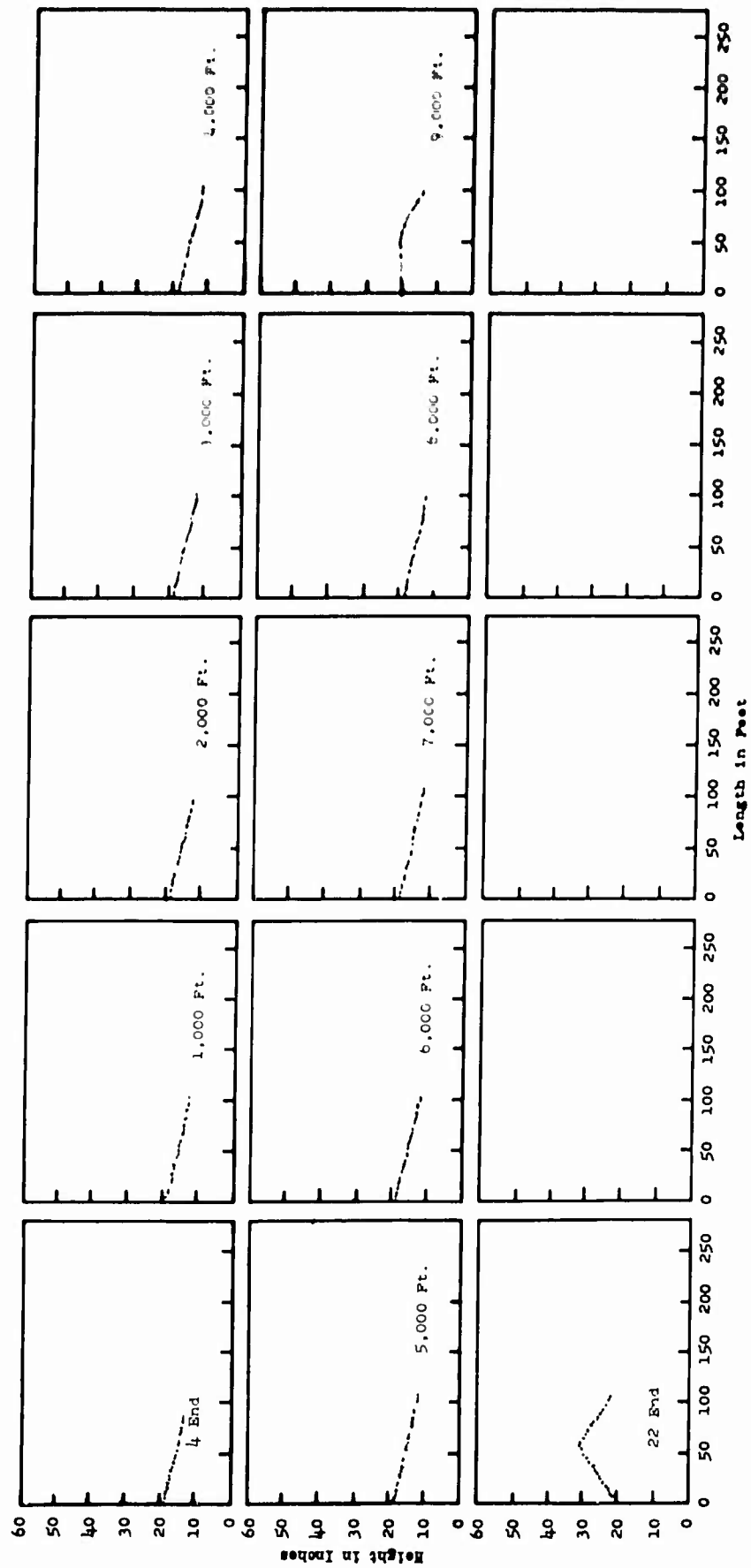


Figure 143 - Cross Run Profiles, Runway 4, Shaw Air Force Base

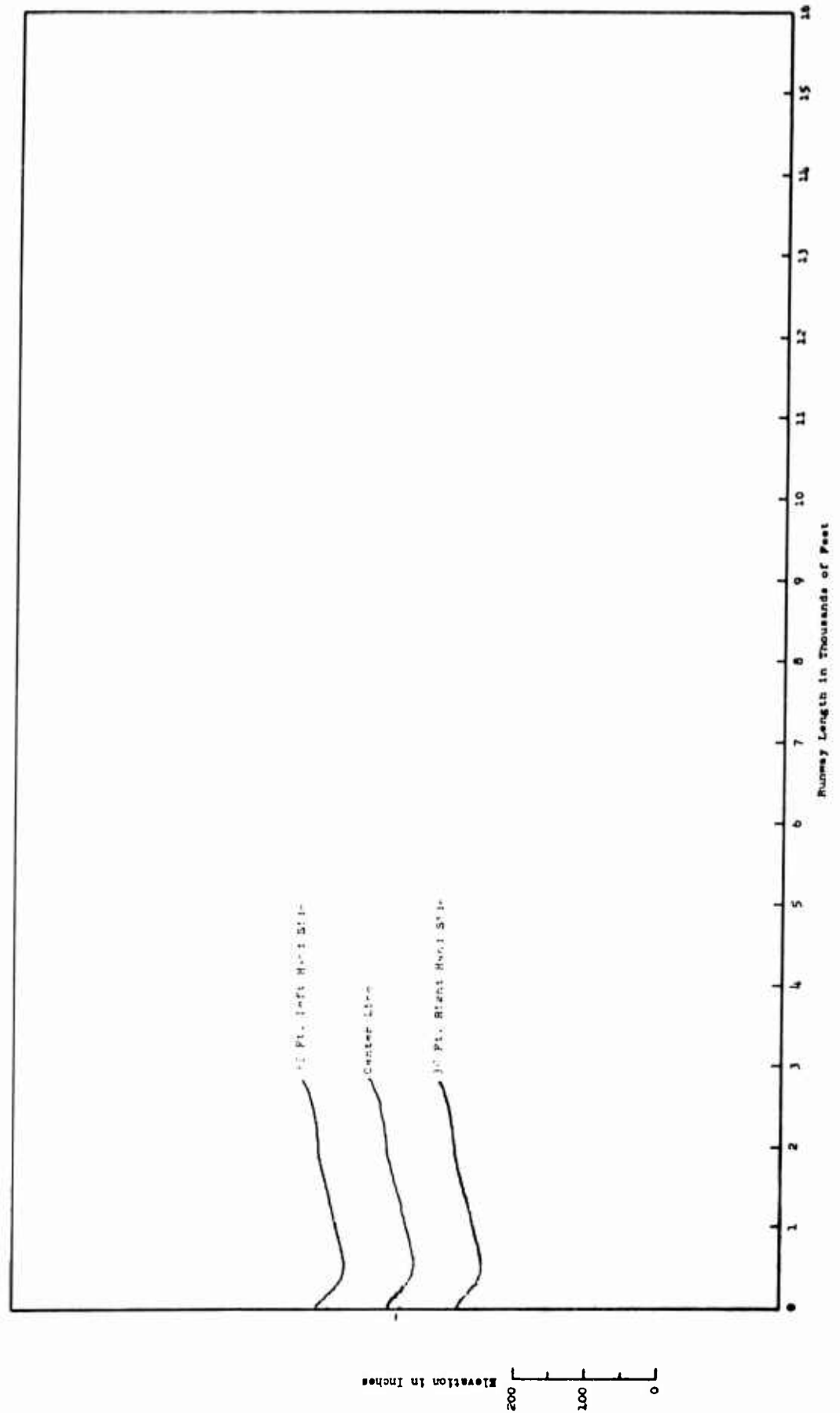


Figure 144 - Profiles, Taxiway, Shaw Air Force Base

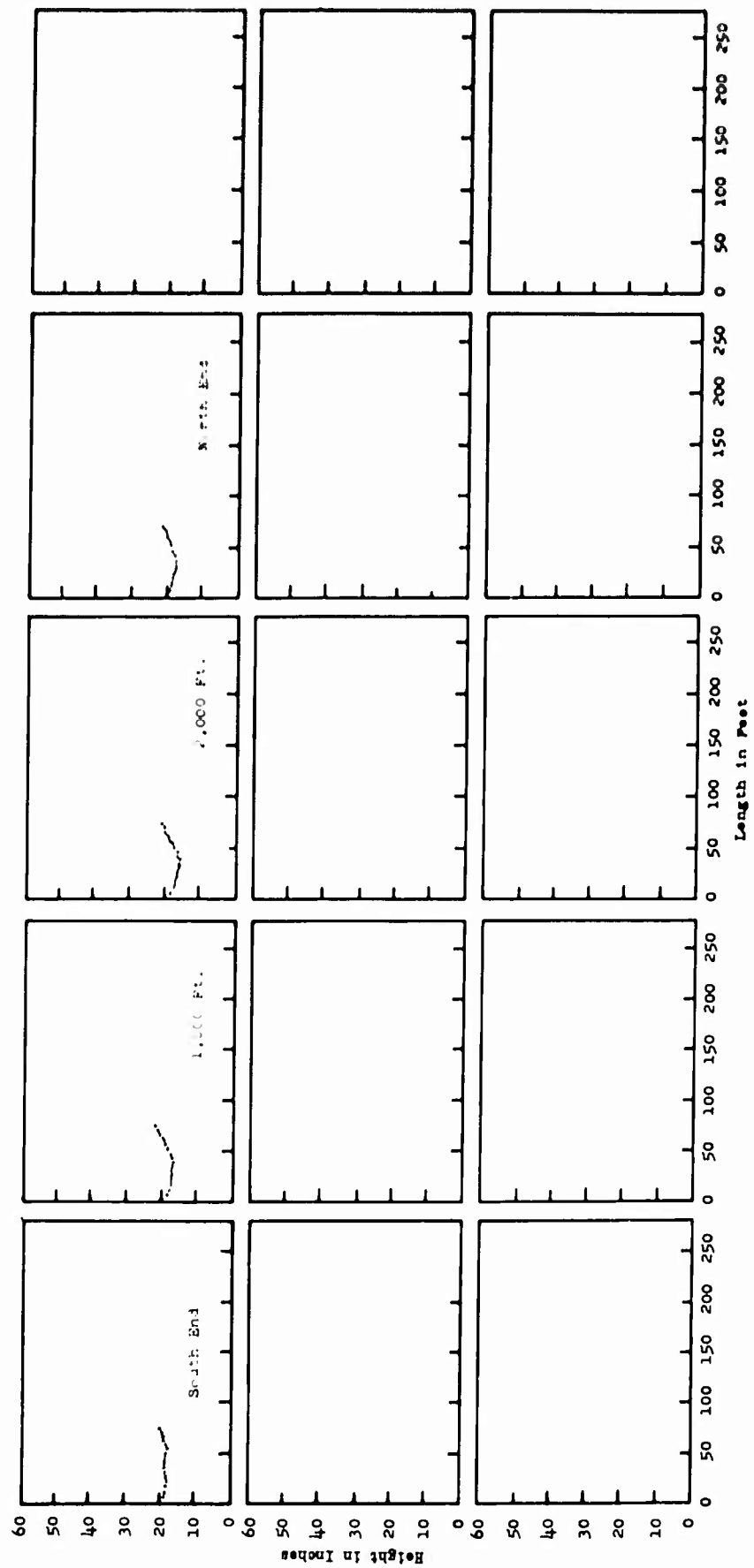


Figure 145 - Cross Run Profiles, Taxiway, Shaw Air Force Base

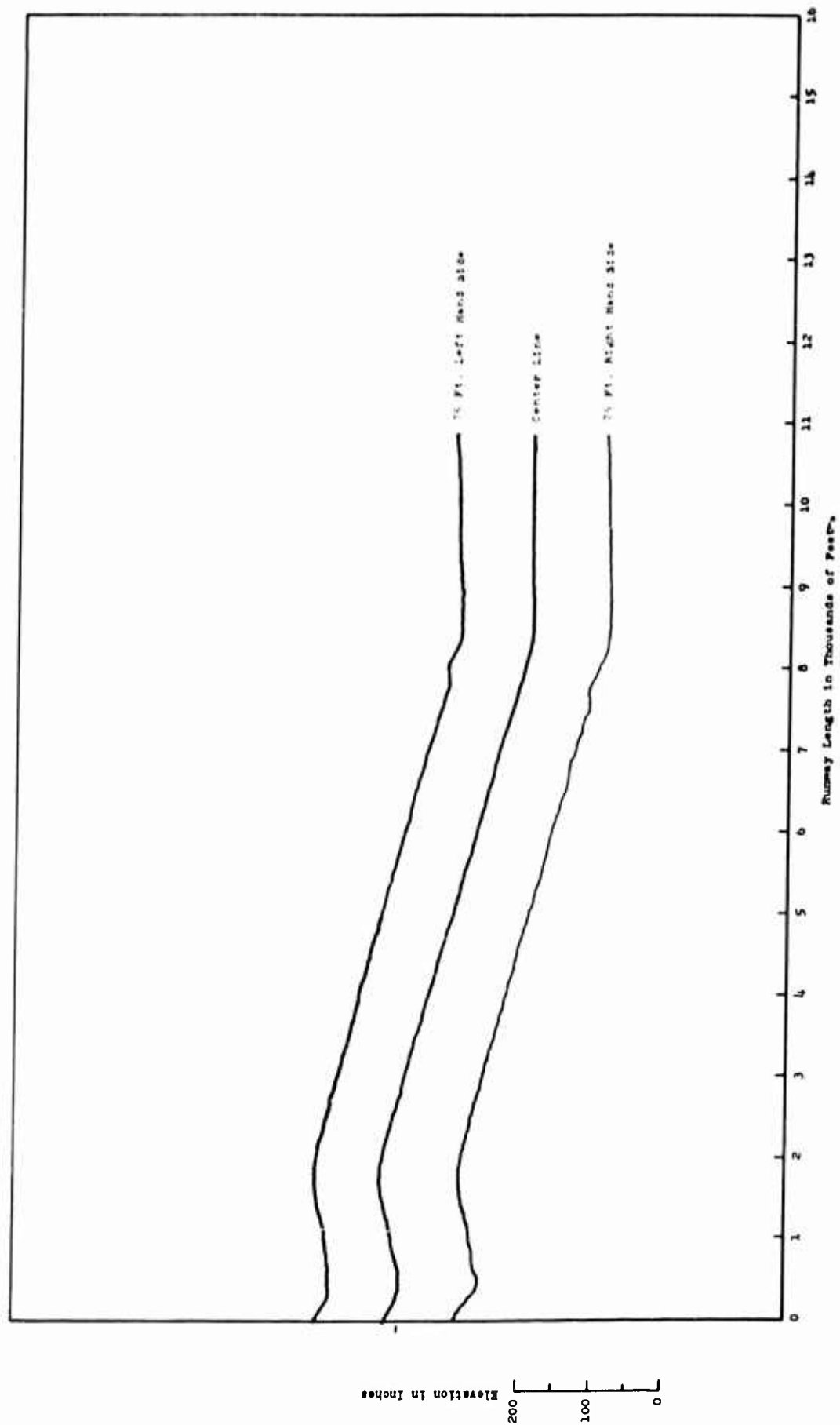


Figure 146 - Profiles, Runway 21R, Travis Air Force Base

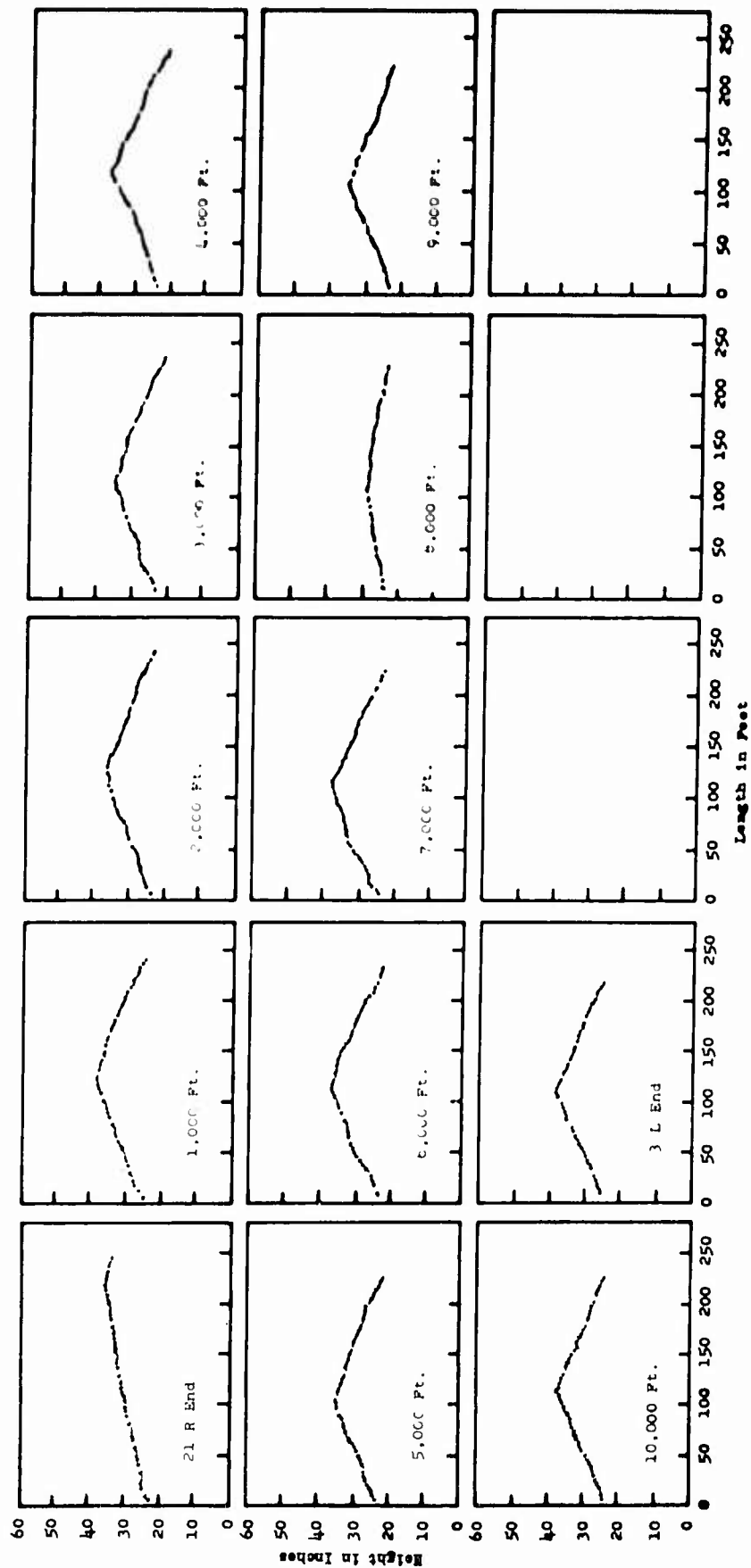


Figure 147 - Cross Run Profiles, Runway 21R, Travis Air Force Base

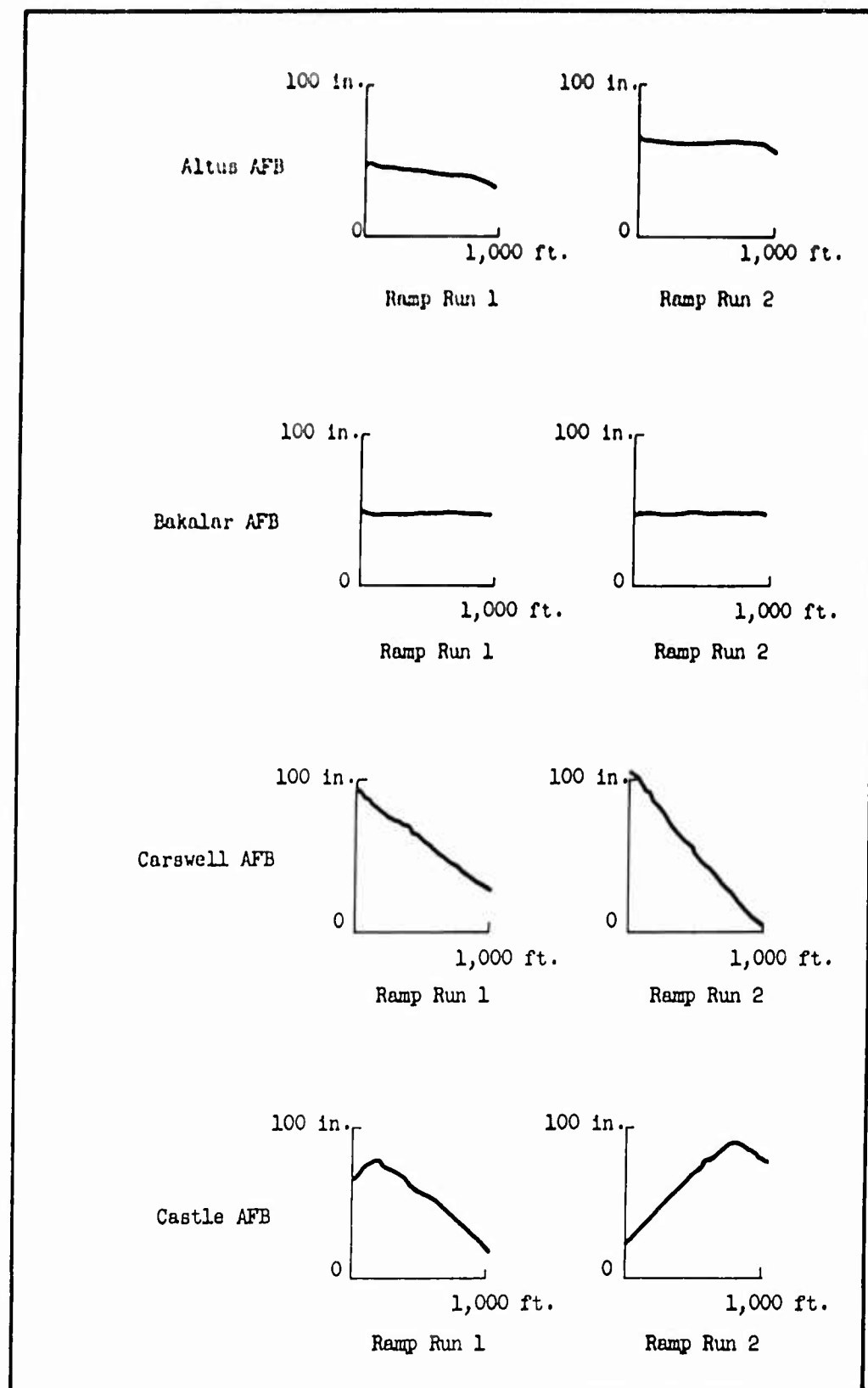


Figure 148 - Ramp Run Profiles

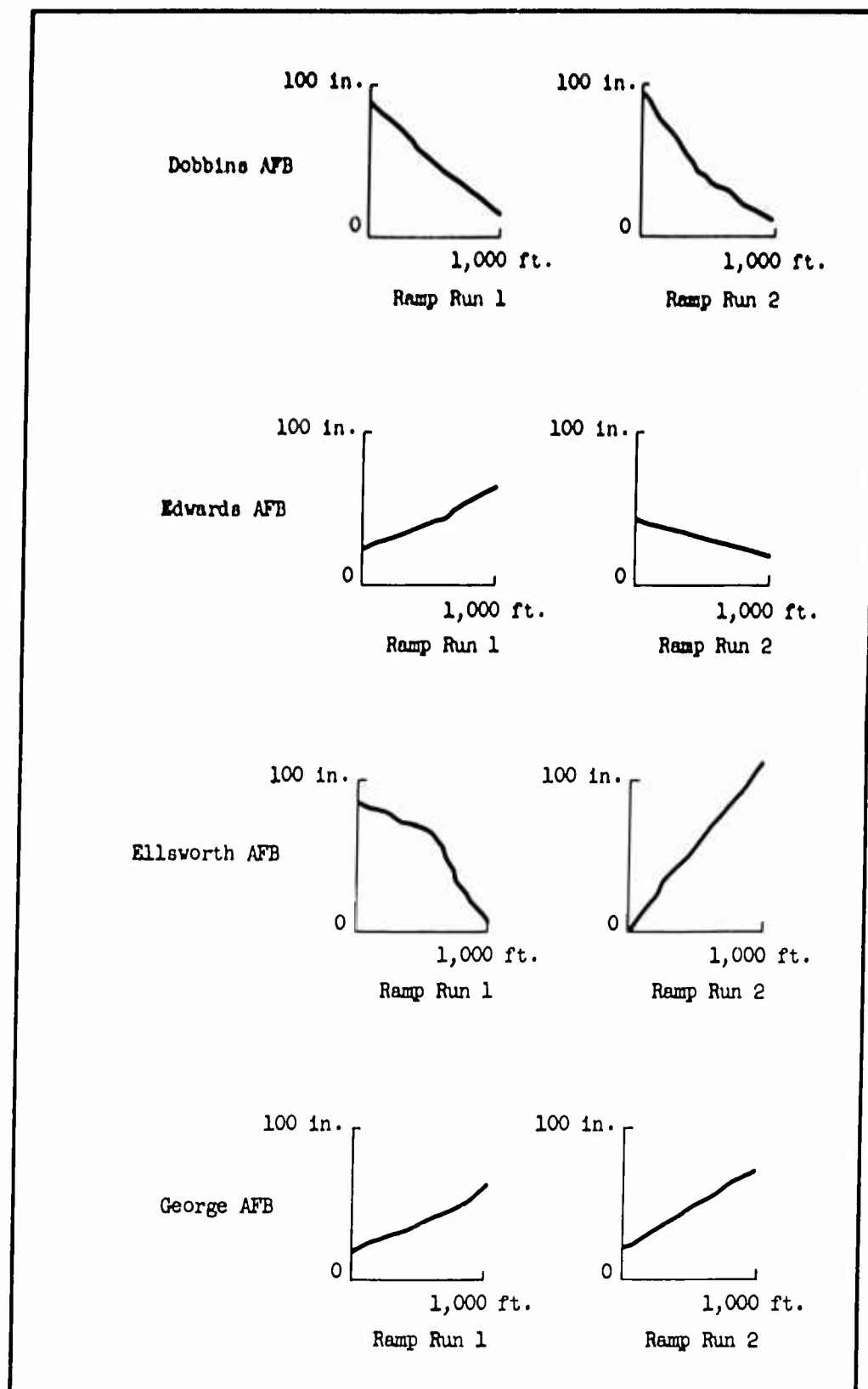


Figure 149 - Ramp Run Profiles

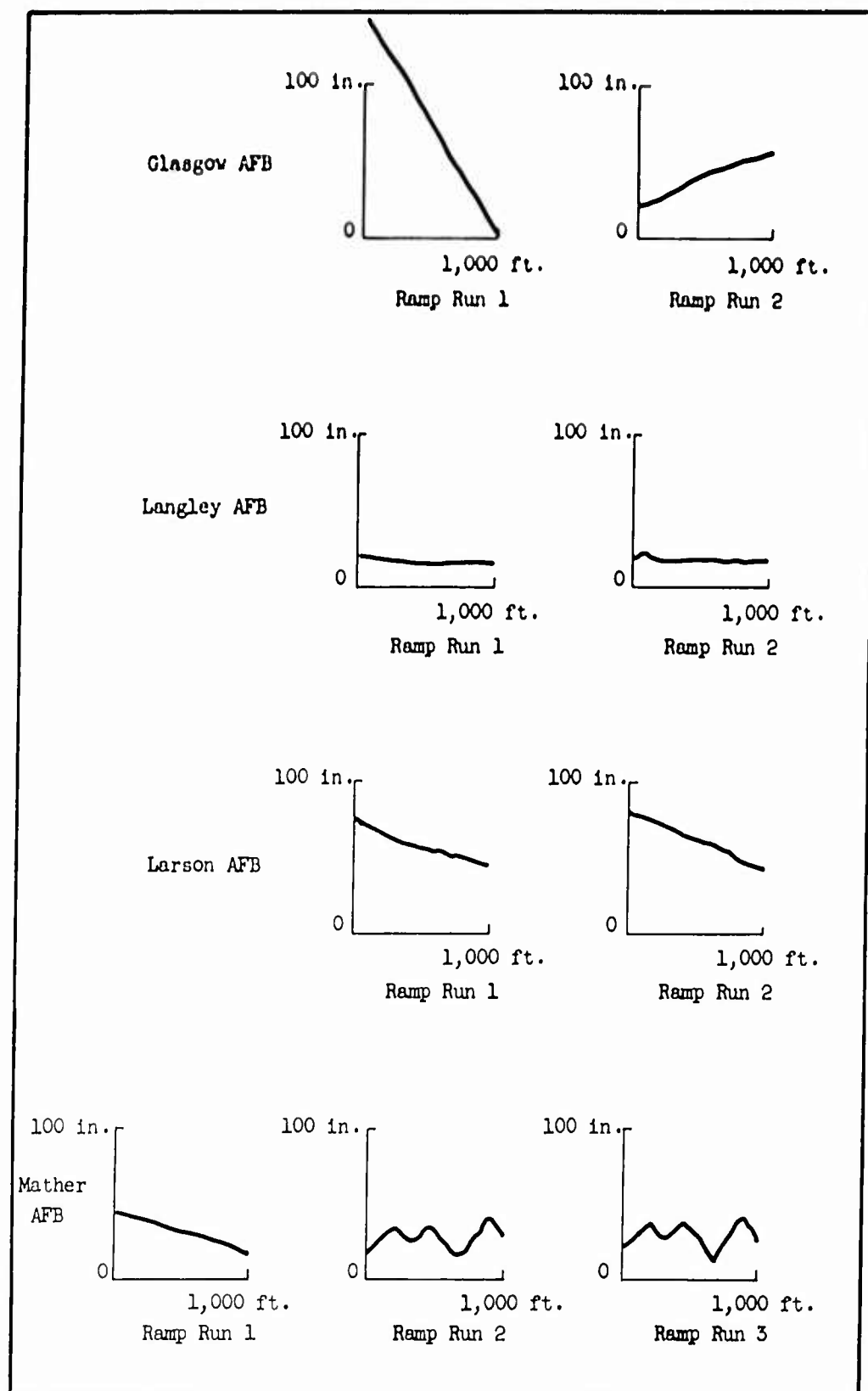


Figure 150 - Ramp Run Profiles

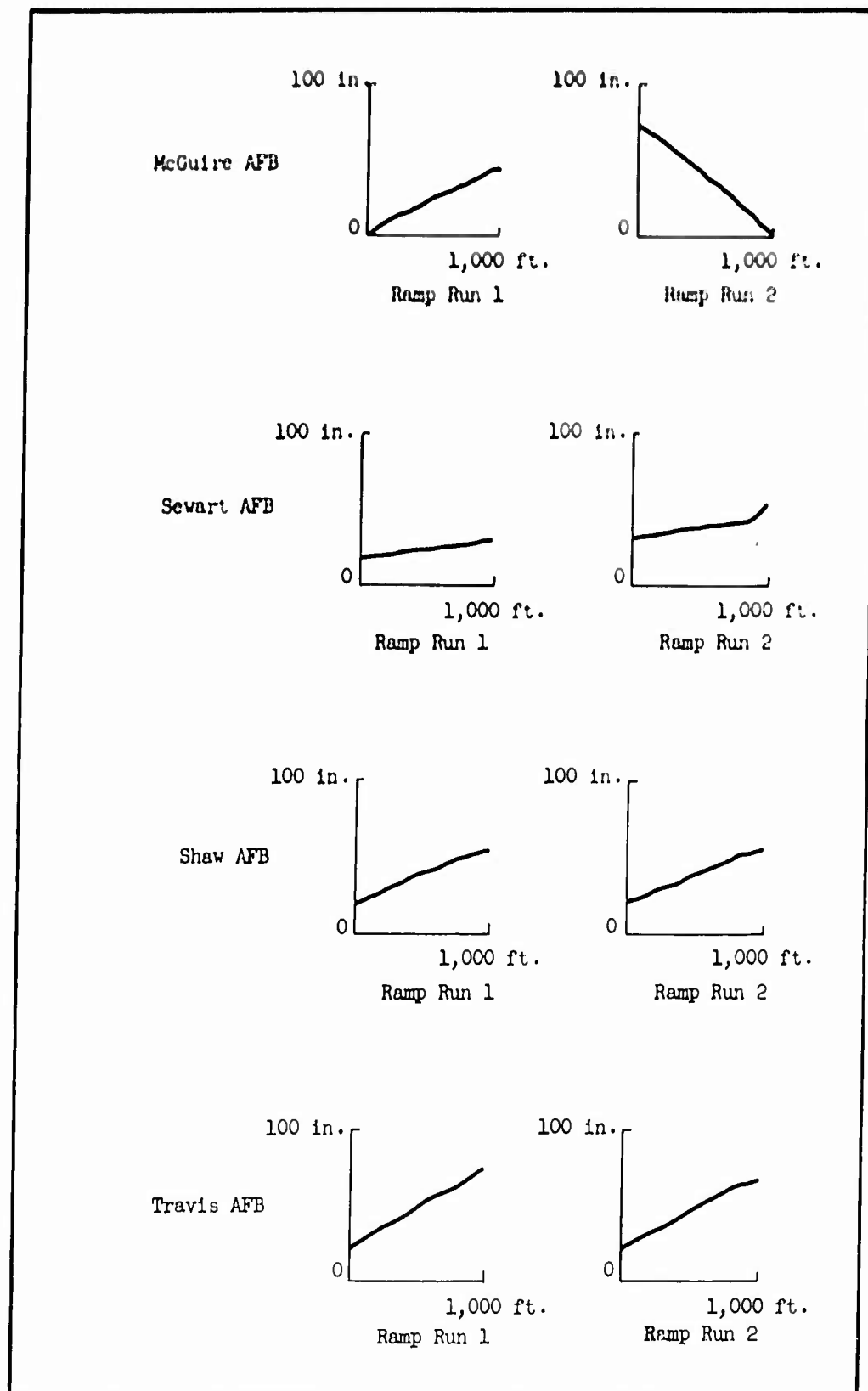


Figure 151 - Ramp Run Profiles

APPENDIX III

BASE MAPS



Figure 152 - Locations of Bases Surveyed

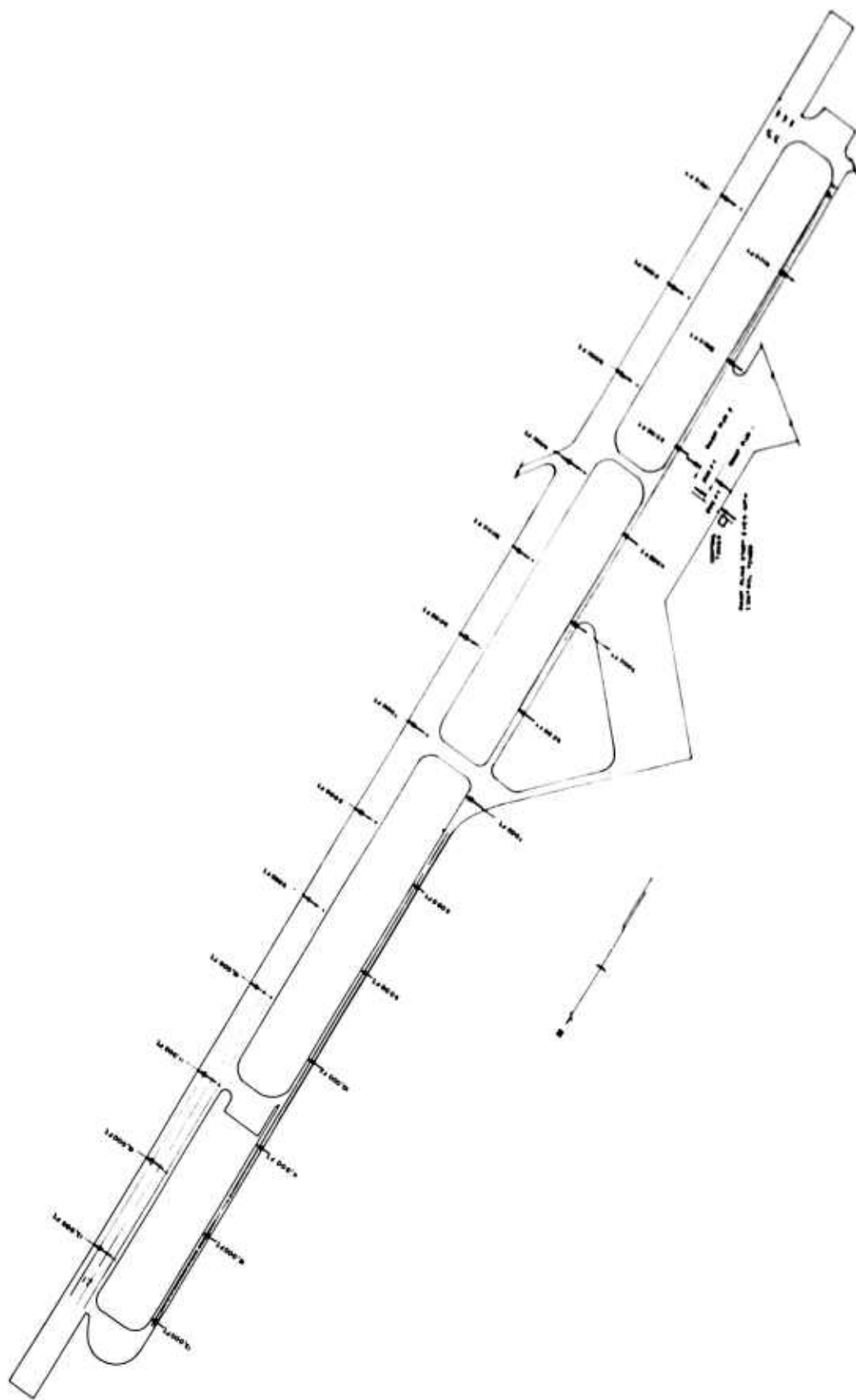


Figure 153 - Location of Lines of Survey, Altus Air Force Base

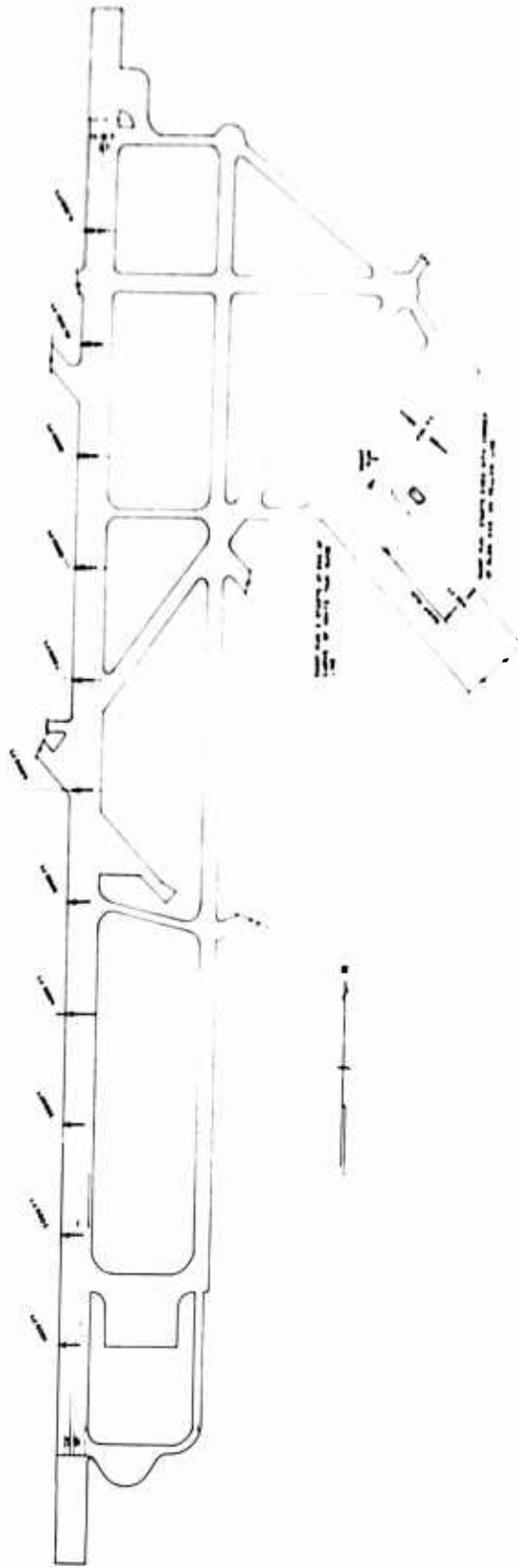


Figure 155 - Location of Lines of Survey, Carswell Air Force Base

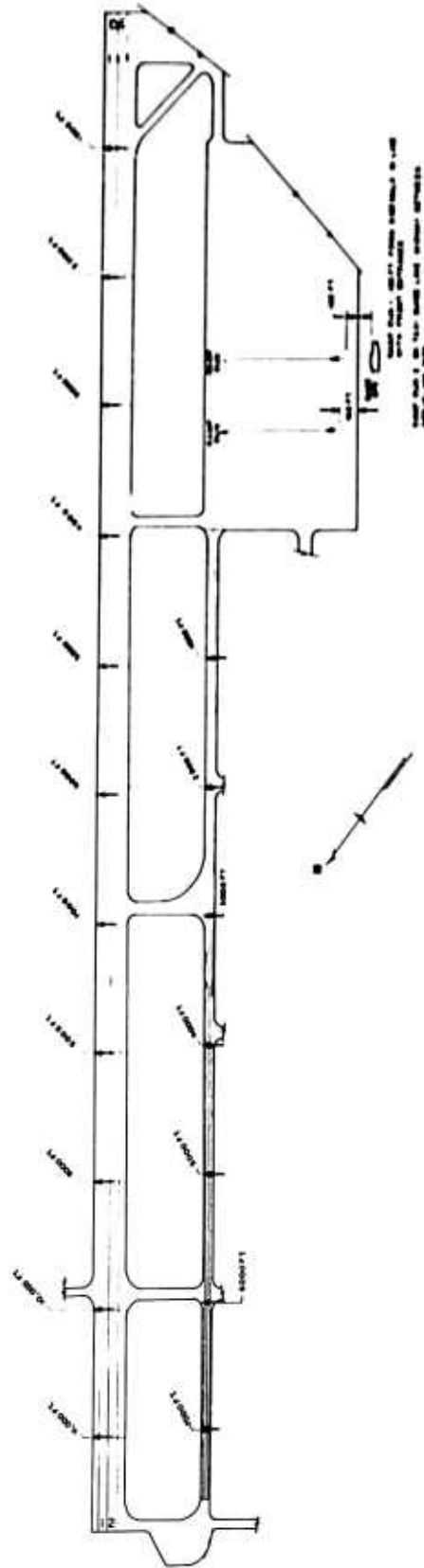


Figure 156 - Location of Lines of Survey, Castle Air Force Base

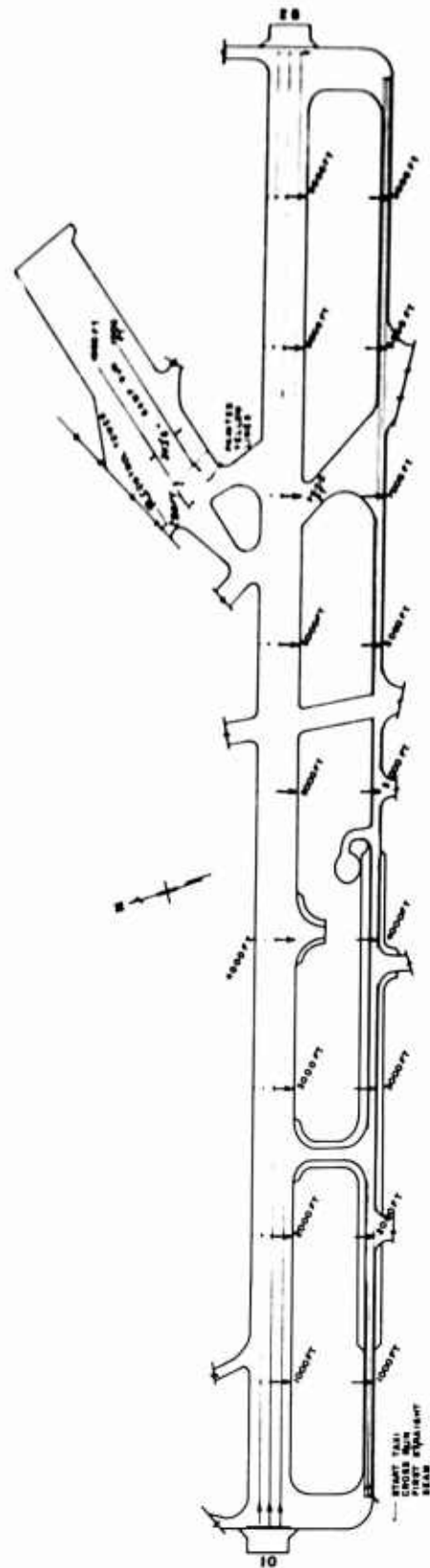


Figure 157 - Location of Lines of Survey, Dobbins Air Force Base

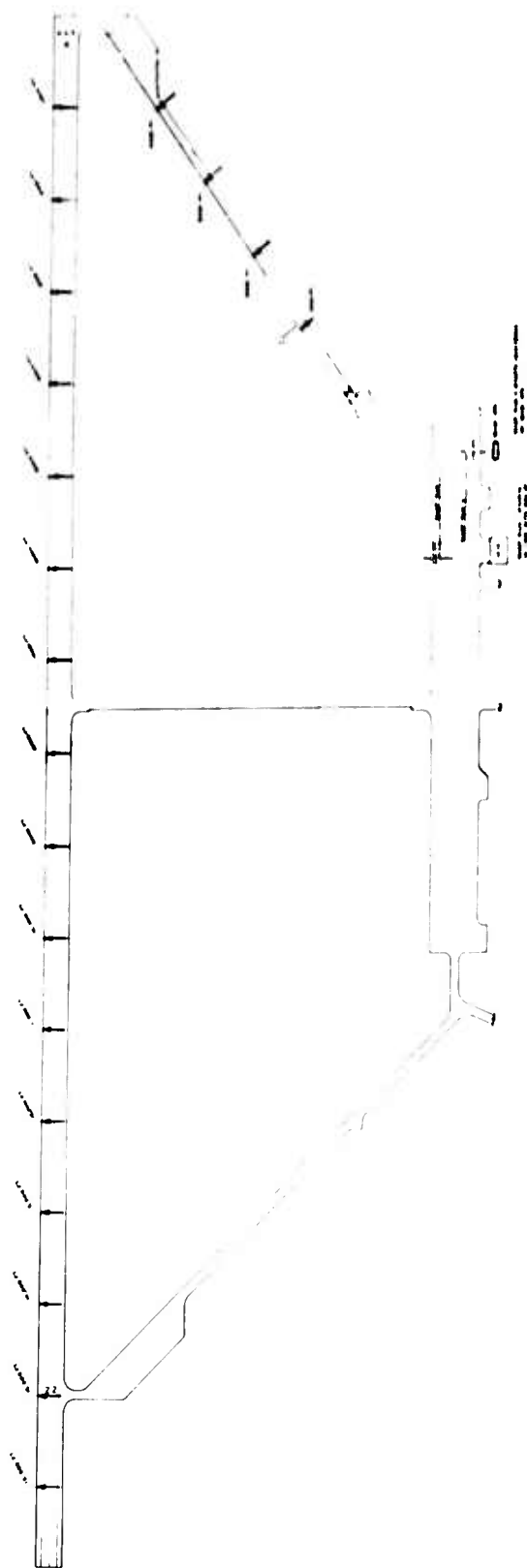


Figure 158 - Location of Lines of Survey, Edwards Air Force Base

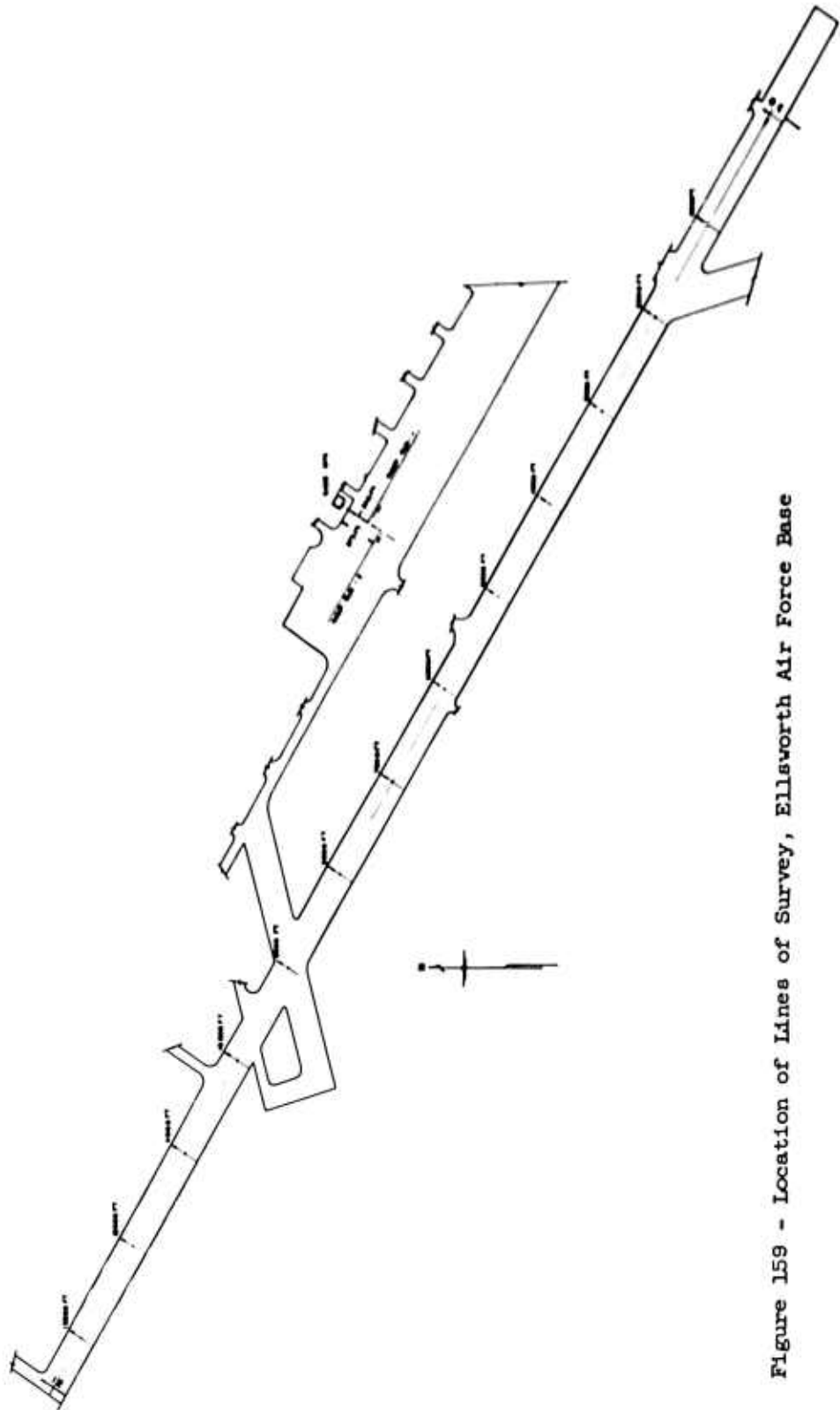


Figure 159 - Location of Lines of Survey, Ellsworth Air Force Base

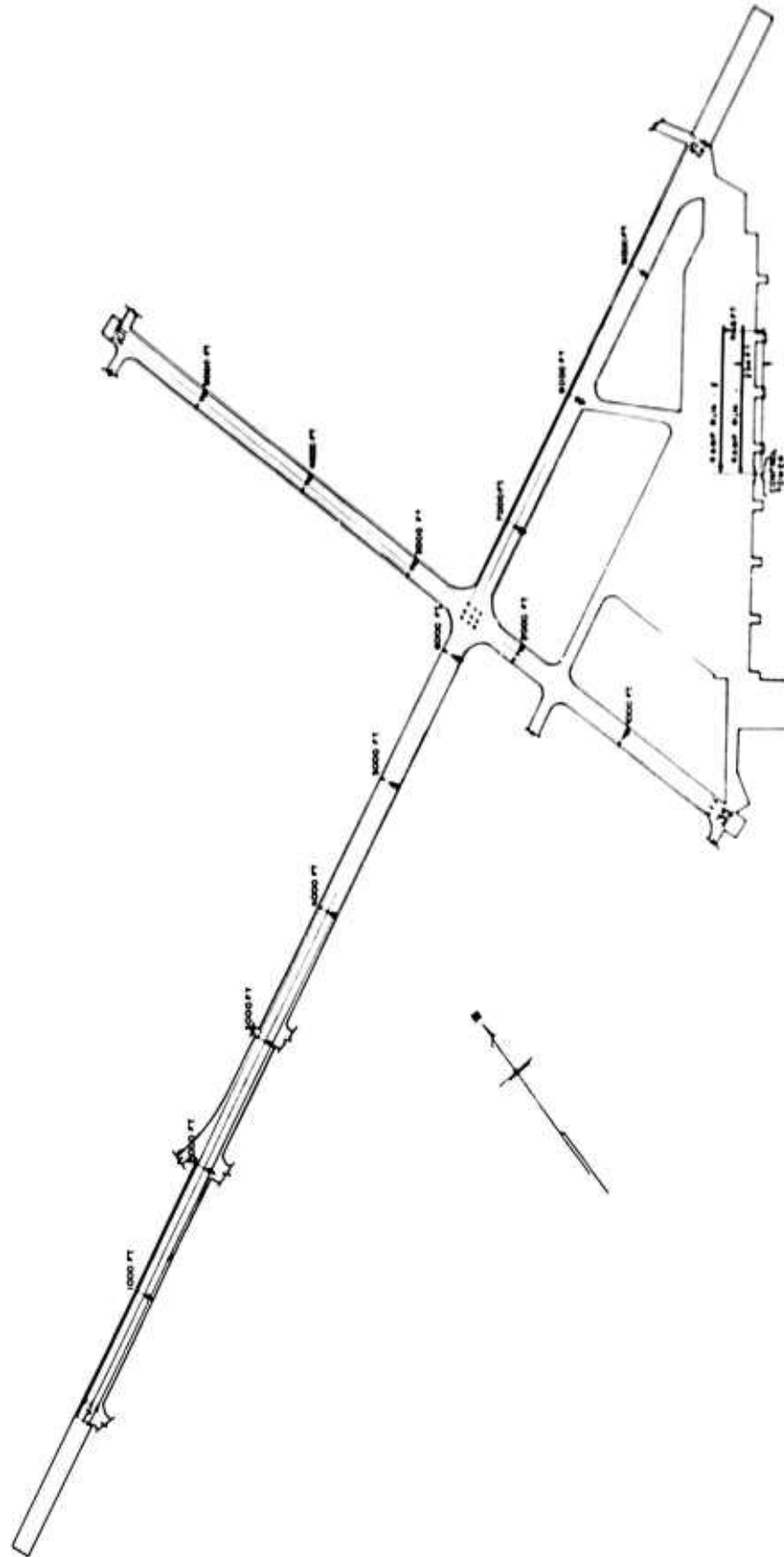


Figure 162 - Location of Lines of Survey, Langley Air Force Base

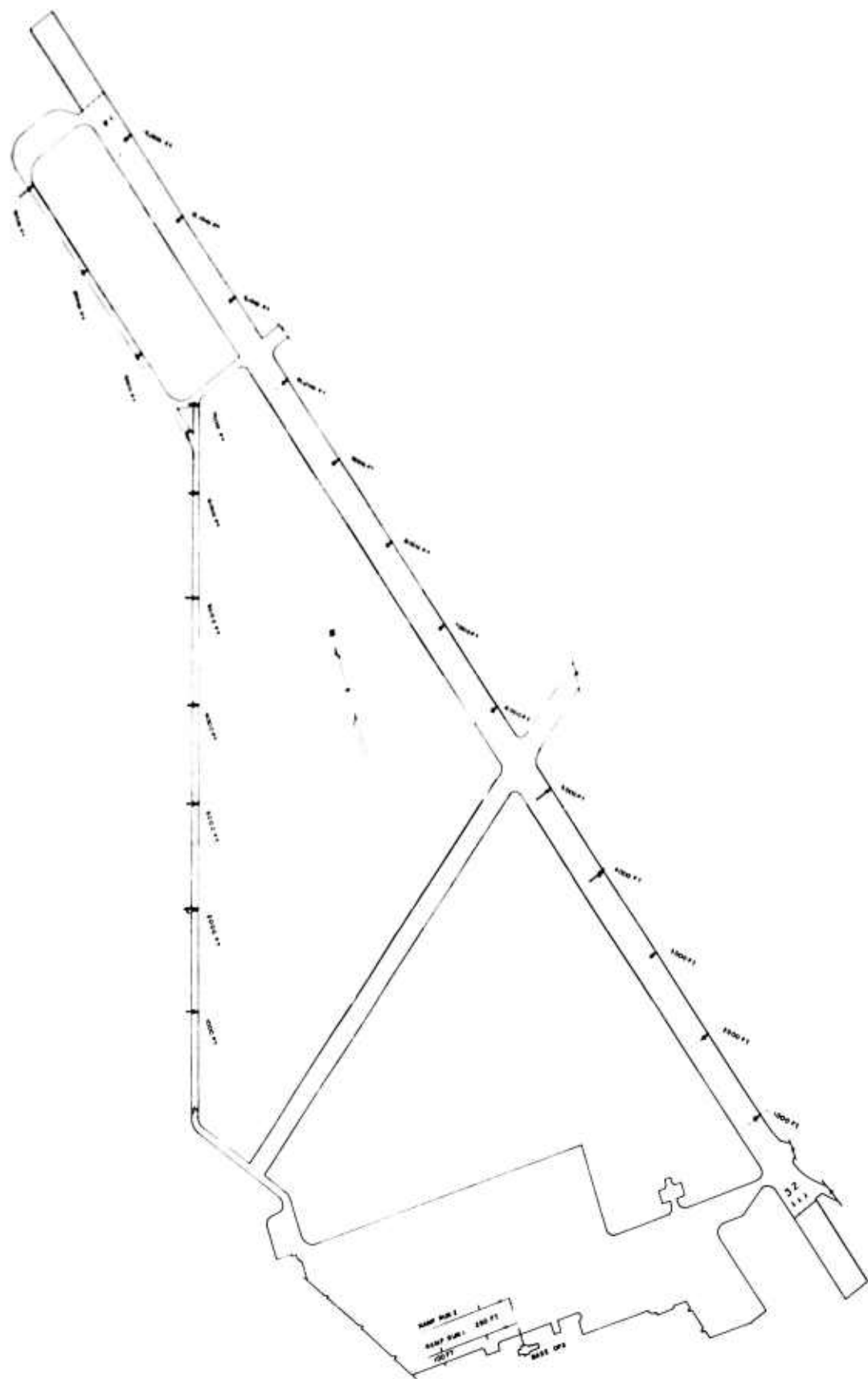


Fig. 163 - Location of Lines of Survey, Larson Air Force Base

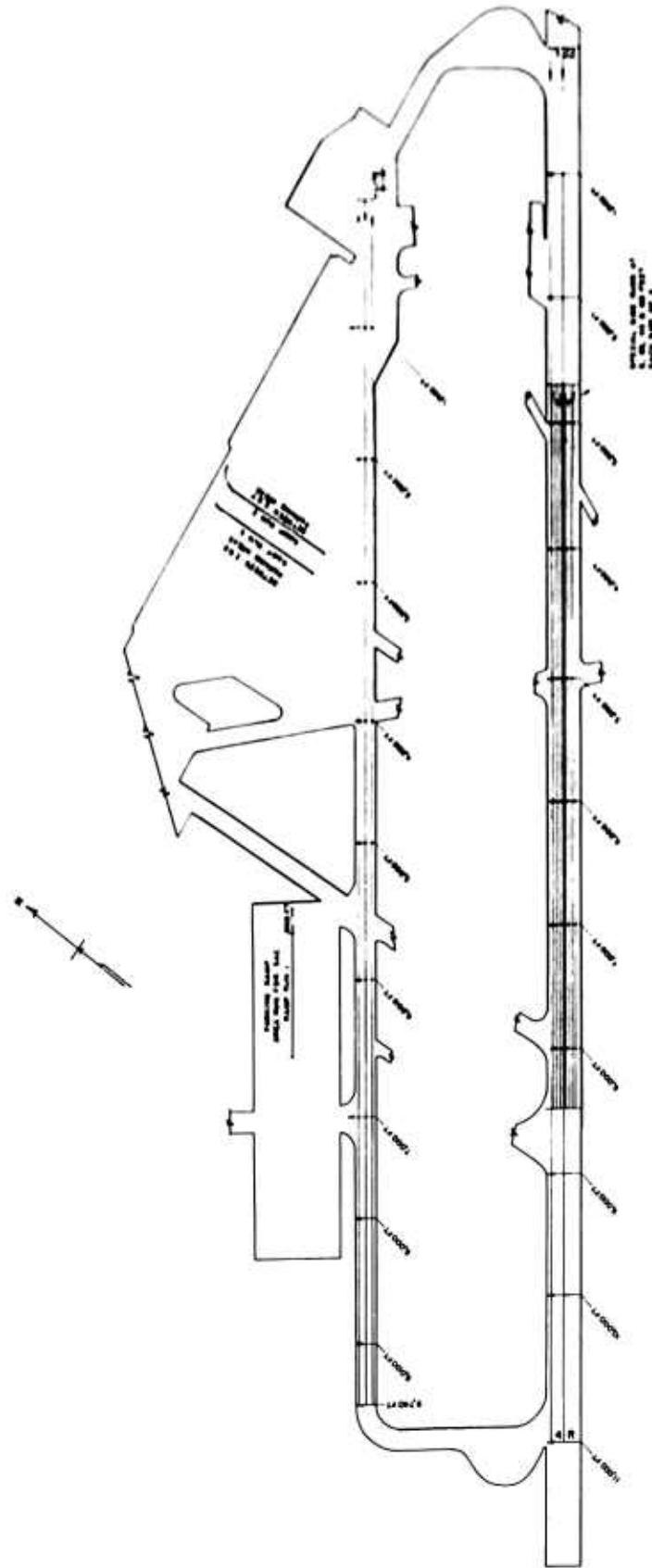


Figure 164 - Location of Lines of Survey, Mather Air Force Base

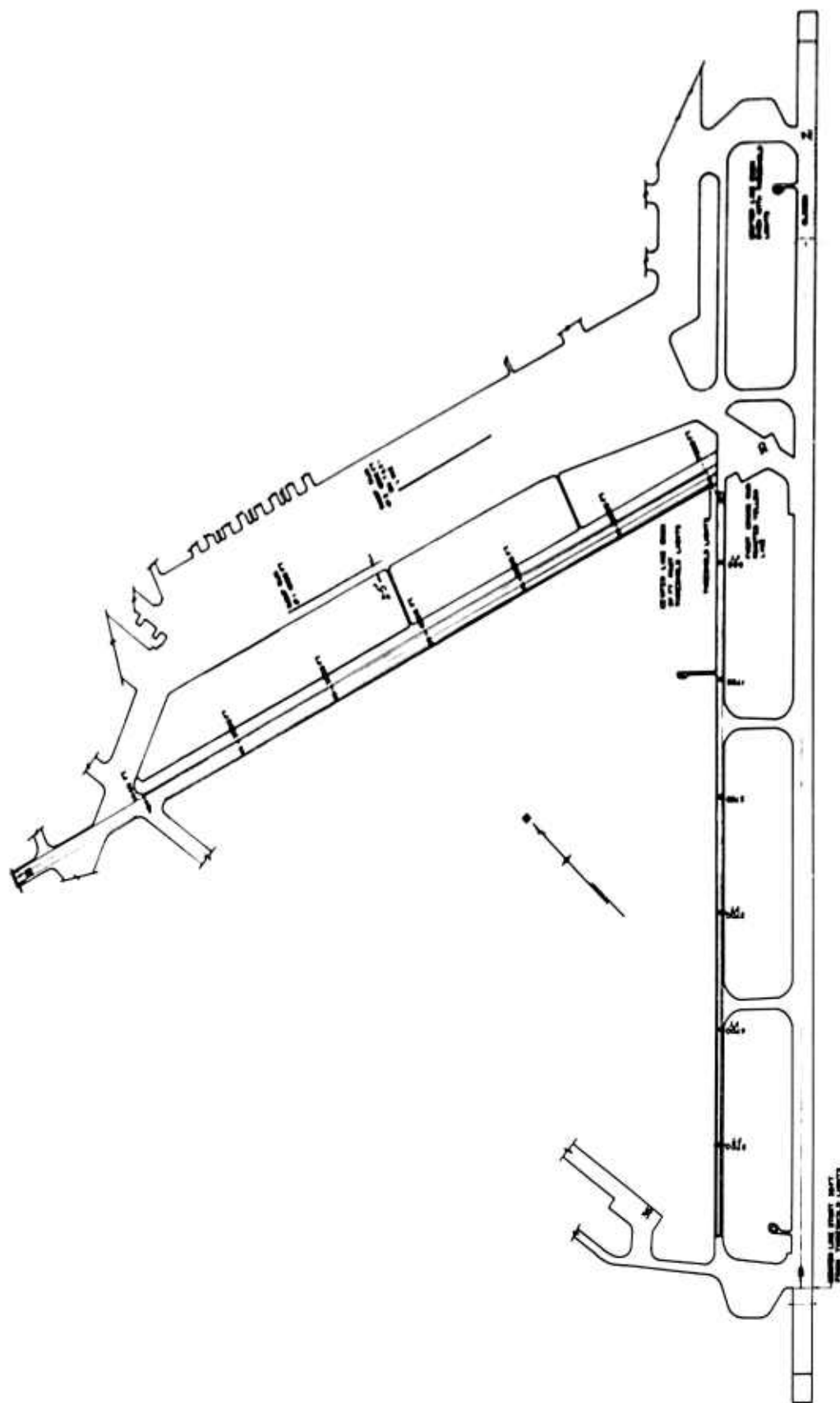


Figure 165 - Location of Lines of Survey, McGuire Air Force Base

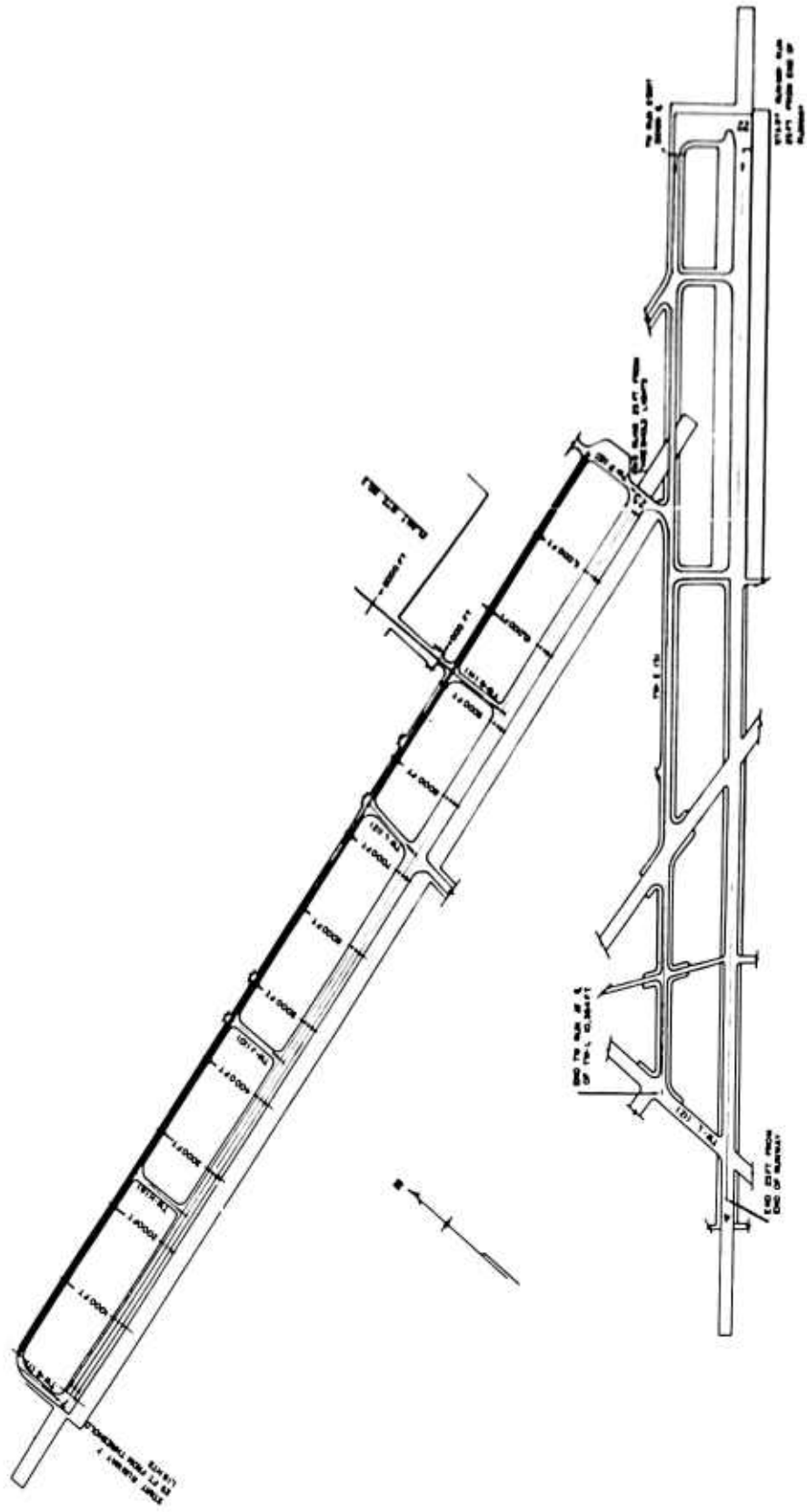


Figure 166 - Location of Lines of Survey, Palmdale Air Force Plant NR42

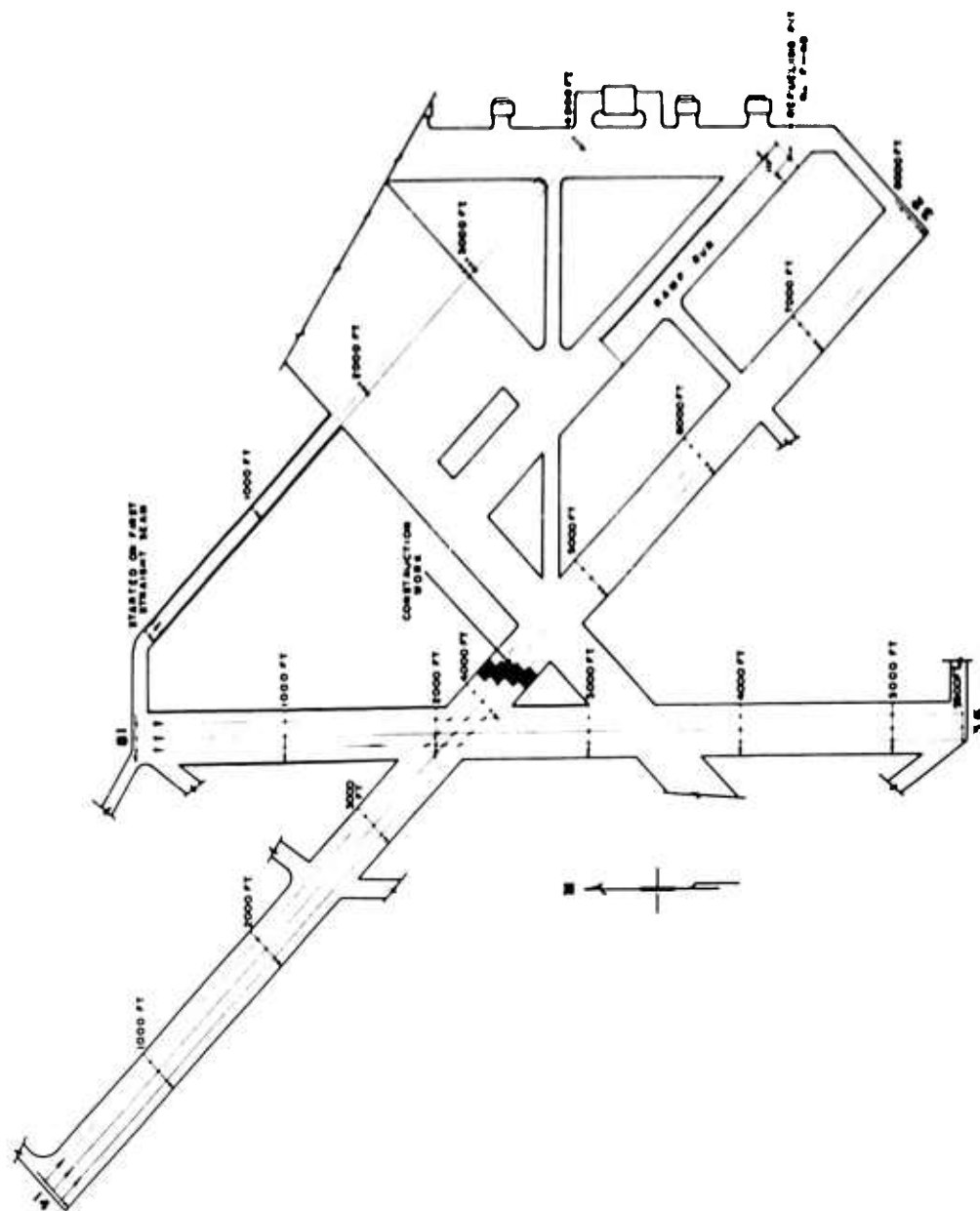


Figure 167 - Location of Lines of Survey, Severt Air Force Base

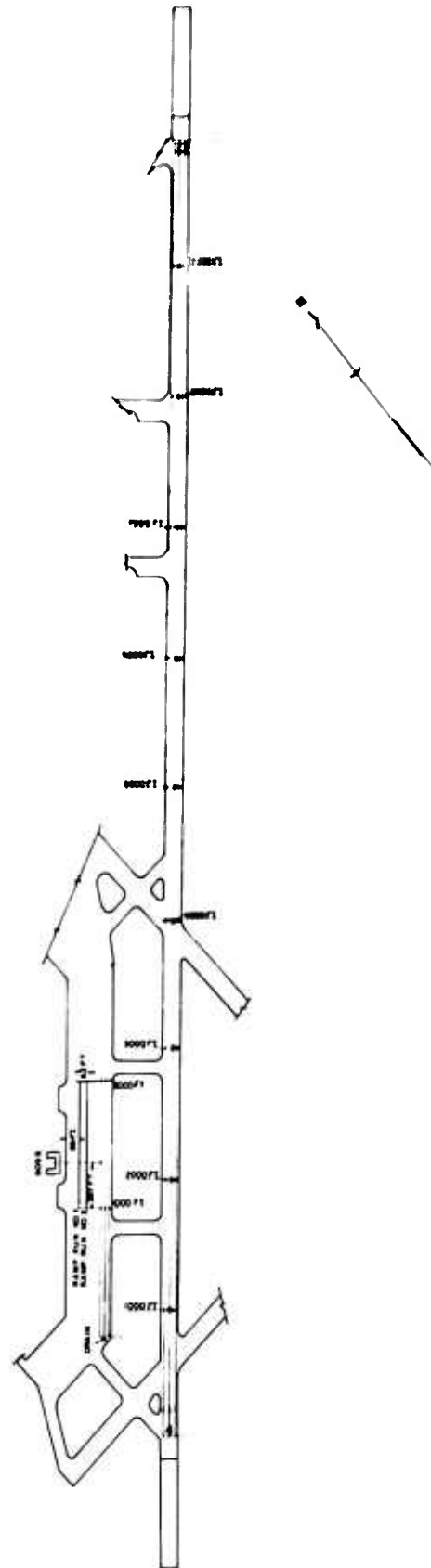


Figure 168 - Location of Lines of Survey, Shaw Air Force Base

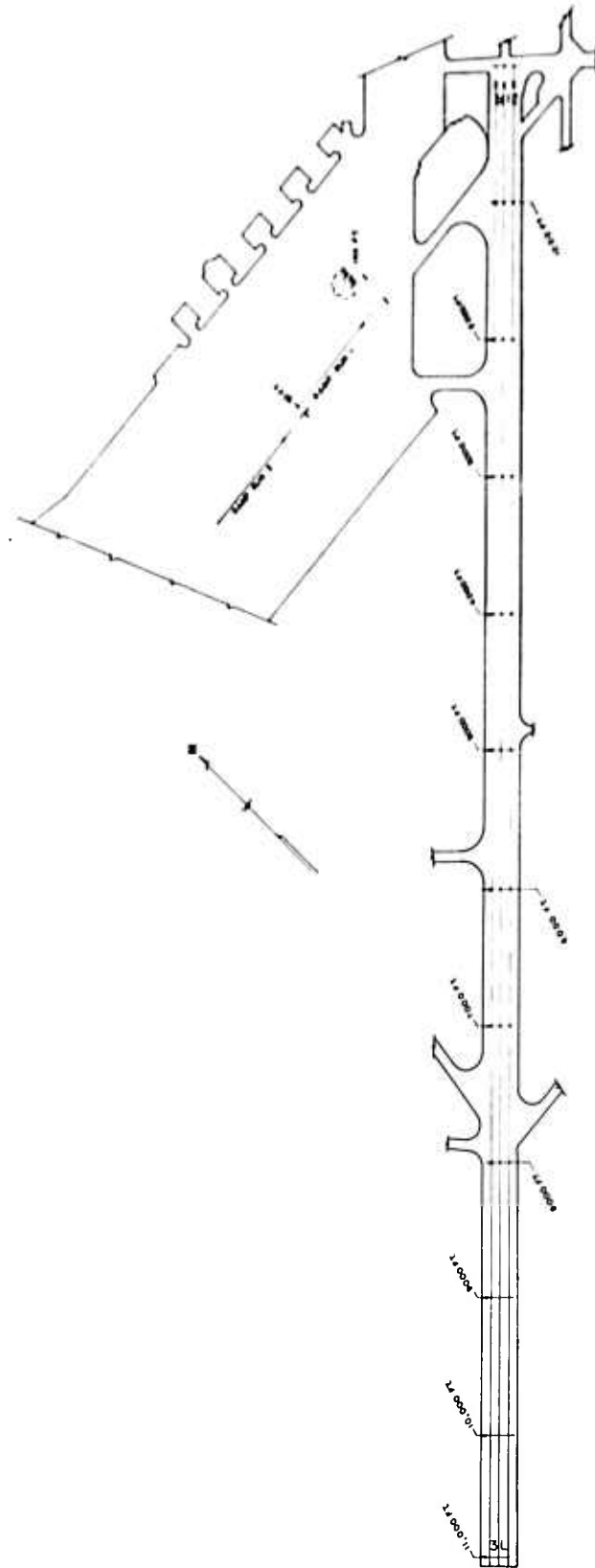


Figure 169 - Location of Lines of Survey, Travis Air Force Base

APPENDIX IV

LISTING OF SURVEY INFORMATION

TABLE 1
ALTUS AIR FORCE BASE
ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R35 75' LH 25' | R35 Center Line 25' | R35 75' RH 25' | T5 25' LH See map | T5 Center Line See map | T5 25' RH See map |
|---------------------|----------------------|---------------------------|----------------------|-------------------------|------------------------------|-------------------------|
| Run Location | | | | | | |
| Starting Point* | | | | | | |
| Cross Run Location | | | | | | |
| 1,000 ft. | 2,412 | 2,408 | 2,403 | 2,010 | 2,006 | 2,011 |
| 2,000 ft. | 4,419 | 4,415 | 4,416 | 4,023 | 4,017 | 4,016 |
| 3,000 ft. | 6,437 | 6,427 | 6,428 | 6,013 | 6,001 | 6,008 |
| 4,000 ft. | 8,444 | 8,438 | 8,432 | 7,979 | 7,967 | 7,972 |
| 5,000 ft. | 10,441 | 10,440 | 10,446 | 9,935 | 9,925 | 9,929 |
| 6,000 ft. | 12,475 | 12,467 | 12,463 | 11,947 | 11,936 | 11,939 |
| 7,000 ft. | 14,471 | 14,468 | 14,469 | 13,959 | 13,945 | 13,950 |
| 8,000 ft. | 16,479 | 16,476 | 16,477 | 15,969 | 15,952 | 15,963 |
| 9,000 ft. | 18,499 | 18,497 | 18,495 | 17,983 | 17,960 | 17,974 |
| 10,000 ft. | 20,516 | 20,505 | 20,502 | 19,993 | 19,971 | 19,982 |
| 11,000 ft. | 22,519 | 22,511 | 22,510 | 21,935 | 21,907 | 21,922 |
| 12,000 ft. | 24,543 | 24,530 | 24,531 | 23,951 | 23,916 | 23,934 |
| 13,000 ft. | 26,926 | 26,917 | 26,916 | 25,560 | 25,529 | 25,544 |
| 14,000 ft. | | | | | | |
| 15,000 ft. | | | | | | |

*Distance from threshold lights to start of run.

TABLE 2

ALTUS AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|-----------|---------------------|--------------------------|--------------------|
| Runway 35 | 35 End | 214 | 441 |
| | 1,000 ft. | 144 | 393 |
| | 2,000 ft. | 149 | 390 |
| | 3,000 ft. | 164 | 393 |
| | 4,000 ft. | 148 | 398 |
| | 5,000 ft. | 154 | 390 |
| | 6,000 ft. | 163 | 413 |
| | 7,000 ft. | 167 | 401 |
| | 8,000 ft. | 191 | 421 |
| | 9,000 ft. | 189 | 421 |
| | 10,000 ft. | 176 | 402 |
| | 11,000 ft. | 195 | 411 |
| | 12,000 ft. | 186 | 403 |
| | 17 End | 228 | 472 |
| Taxiway 5 | 35 End | 56 | 126 |
| | 1,000 ft. | 54 | 114 |
| | 2,000 ft. | 54 | 112 |
| | 3,000 ft. | 57 | 121 |
| | 4,000 ft. | 61 | 121 |
| | 5,000 ft. | 56 | 111 |
| | 6,000 ft. | 52 | 112 |
| | 7,000 ft. | 53 | 115 |
| | 8,000 ft. | 52 | 116 |
| | 9,000 ft. | 52 | 117 |
| | 10,000 ft. | 55 | 112 |
| | 11,000 ft. | 80 | 164* |
| | 12,000 ft. | 85 | 177 |
| | 17 End | 77 | 164 |

*Taxi wider from this point.

TABLE 3
BAKALAR AIR FORCE BASE
ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R13 | R13 | R13 | R18 | R18 | R18 | R18 | R22 | R22 | R22 |
|---------------------|--------|-------------|--------|--------|-------------|--------|--------|-------------|--------|--------|
| Run Location | 50' LH | Center Line | 50' RH | 50' LH | Center Line | 50' RH | 50' LH | Center Line | 50' RH | 50' RH |
| Starting Point* | 39'6" | 39' | 40'4" | 18' | 18' | 18'10" | 27'5" | 25' | 24' | |
| Cross Run Location | | | | | | | | | | |
| 1,000 ft. | 2,031 | 2,035 | 2,030 | 1,667 | 1,662 | 1,655 | 1,624 | 1,631 | 1,633 | |
| 2,000 ft. | 4,097 | 4,103 | 4,092 | 3,713 | 3,711 | 3,707 | 3,687 | 3,692 | 3,686 | |
| 3,000 ft. | 6,174 | 6,180 | 6,176 | 5,756 | 5,756 | 5,753 | 5,917 | 5,928 | 5,926 | |
| 4,000 ft. | 8,235 | 8,242 | 8,229 | 7,762 | 7,767 | 7,759 | 7,967 | 7,977 | 7,960 | |
| 5,000 ft. | 10,014 | 10,019 | 10,006 | 10,015 | 10,018 | 10,007 | 9,990 | 10,009 | 10,003 | |
| 6,000 ft. | | | | | | | | | | |
| 7,000 ft. | | | | | | | | | | |
| 8,000 ft. | | | | | | | | | | |
| 9,000 ft. | | | | | | | | | | |
| 10,000 ft. | | | | | | | | | | |
| 11,000 ft. | | | | | | | | | | |
| 12,000 ft. | | | | | | | | | | |
| 13,000 ft. | | | | | | | | | | |
| 14,000 ft. | | | | | | | | | | |
| 15,000 ft. | | | | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 3 (Concluded)

BAKALAR AIR FORCE BASE

ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | T27 | T27 | T27 | T3 | T3 | T3 | T3 |
|---------------------|---------|-------------|---------|---------|-------------|---------|----|
| Run Location | 30' LH | Center Line | 30' RH | 30' LH | Center Line | 30' RH | |
| Starting Point* | See map | See map | See map | See map | See map | See map | |
| Cross Run Location | | | | | | | |
| 1,000 ft. | 2,404 | 2,406 | 2,383 | 1,998 | 1,999 | 1,990 | |
| 2,000 ft. | 4,823 | 4,821 | 4,793 | 2,991 | 3,011 | 3,002 | |
| 3,000 ft. | 7,223 | 7,222 | 7,201 | | | | |
| 4,000 ft. | 7,941 | 7,943 | 7,927 | | | | |
| 5,000 ft. | | | | | | | |
| 6,000 ft. | | | | | | | |
| 7,000 ft. | | | | | | | |
| 8,000 ft. | | | | | | | |
| 9,000 ft. | | | | | | | |
| 10,000 ft. | | | | | | | |
| 11,000 ft. | | | | | | | |
| 12,000 ft. | | | | | | | |
| 13,000 ft. | | | | | | | |
| 14,000 ft. | | | | | | | |
| 15,000 ft. | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 4

BAKALAR AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|------------|---------------------|--------------------------|--------------------|
| Runway 13 | 13 End | 122 | 257 |
| | 1,000 ft. | 124 | 255 |
| | 2,000 ft. | 119 | 250 |
| | 3,000 ft. | 125 | 259 |
| | 4,000 ft. | 122 | 257 |
| | 31 End | 119 | 263 |
| | | | |
| Runway 18 | 18 End | 105 | 254 |
| | 1,000 ft. | 120 | 253 |
| | 2,000 ft. | 116 | 249 |
| | 3,000 ft. | 122 | 252 |
| | 4,000 ft. | 121 | 253 |
| | 36 End | 120 | 260 |
| | | | |
| Runway 22 | 22 End | 125 | 258 |
| | 1,000 ft. | 123 | 263 |
| | 2,000 ft. | 124 | 259 |
| | 3,000 ft. | 121 | 258 |
| | 4,000 ft. | 123 | 257 |
| | 4 End | 146 | 258 |
| | | | |
| Taxiway 27 | West End | 46 | 120 |
| | 1,000 ft. | 63 | 119 |
| | 2,000 ft. | 47 | 104 |
| | 3,000 ft. | 47 | 102 |
| | East End | 49 | 106 |
| | | | |
| Taxiway 3 | South End | 46 | 106 |
| | 1,000 ft. | 43 | 103 |
| | North End | 46 | 106 |

TABLE 5
CARSWELL AIR FORCE BASE
ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R17 87' LH | R17 37' LH | R17 13' LH | R17 13' RH | R17 37' RH | | | | |
|---------------------|---------------|---------------|---------------|---------------|---------------|--|--|--|--|
| Run Location | 25' | 25' | 25' | 25' | 25' | | | | |
| Starting Point* | | | | | | | | | |
| Cross Run Location | | | | | | | | | |
| 1,000 ft. | 1,966 | 1,964 | 1,963 | 1,965 | 1,965 | | | | |
| 2,000 ft. | 3,978 | 3,979 | 3,976 | 3,981 | 3,980 | | | | |
| 3,000 ft. | 5,994 | 5,990 | 5,988 | 5,994 | 5,991 | | | | |
| 4,000 ft. | 8,010 | 7,999 | 8,001 | 8,009 | 8,005 | | | | |
| 5,000 ft. | 10,025 | 10,010 | 10,013 | 10,023 | 10,018 | | | | |
| 6,000 ft. | 12,039 | 12,023 | 12,024 | 12,036 | 12,030 | | | | |
| 7,000 ft. | 14,051 | 14,033 | 14,034 | 14,049 | 14,043 | | | | |
| 8,000 ft. | 16,064 | 16,044 | 16,045 | 16,057 | 16,055 | | | | |
| 9,000 ft. | 18,077 | 18,056 | 18,055 | 18,067 | 18,067 | | | | |
| 10,000 ft. | 20,095 | 20,071 | 20,065 | 20,078 | 20,078 | | | | |
| 11,000 ft. | 22,106 | 22,081 | 22,074 | 22,089 | 22,092 | | | | |
| 12,000 ft. | 24,068 | 24,043 | 24,037 | 24,052 | 24,051 | | | | |
| 13,000 ft. | | | | | | | | | |
| 14,000 ft. | | | | | | | | | |
| 15,000 ft. | | | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 6

CARSWELL AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Count-12-1/2 IN Side</u> | <u>Final Count</u> |
|-----------|---------------------|-----------------------------|--------------------|
| Runway 35 | 35 End | 259 | 528 |
| | 1,000 ft. | 268 | 511 |
| | 2,000 ft. | 262 | 470 |
| | 3,000 ft. | 257 | 477 |
| | 4,000 ft. | 259 | 453 |
| | 5,000 ft. | 257 | 442 |
| | 6,000 ft. | 254 | 429 |
| | 7,000 ft. | 248 | 430 |
| | 8,000 ft. | 250 | 441 |
| | 9,000 ft. | 250 | 440 |
| | 10,000 ft. | 251 | 310 |
| | 11,000 ft. | 243 | 425 |
| | 7 End | 252 | 435 |

TABLE 7
CASTLE AIR FORCE BASE
ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R30 | R30 | R30 | T9 | T9 | T9 | T9 |
|---------------------|--------|-------------|--------|---------|-------------|---------|----|
| Run Location | 75' IH | Center Line | 75' RH | 50' IH | Center Line | 50' RH | |
| Starting Point* | 40' | 40' | 40' | See map | See map | See map | |
| Cross Run Location | | | | | | | |
| 1,000 ft. | 2,761 | 2,757 | 2,762 | 1,914 | 1,907 | 1,914 | |
| 2,000 ft. | 4,749 | 4,749 | 4,750 | 3,914 | 3,911 | 3,915 | |
| 3,000 ft. | 6,761 | 6,762 | 6,761 | 6,025 | 6,016 | 6,016 | |
| 4,000 ft. | 8,775 | 8,771 | 8,775 | 8,126 | 8,123 | 8,128 | |
| 5,000 ft. | 10,783 | 10,782 | 10,785 | 10,141 | 10,134 | 10,136 | |
| 6,000 ft. | 12,792 | 12,790 | 12,792 | 12,283 | 12,279 | 12,284 | |
| 7,000 ft. | 14,814 | 14,803 | 14,822 | 14,685 | 14,662 | 14,676 | |
| 8,000 ft. | 16,818 | 16,815 | 16,830 | | | | |
| 9,000 ft. | 18,833 | 18,828 | 18,837 | | | | |
| 10,000 ft. | 20,836 | 20,831 | 20,840 | | | | |
| 11,000 ft. | 23,636 | 23,606 | 23,647 | | | | |
| 12,000 ft. | | | | | | | |
| 13,000 ft. | | | | | | | |
| 14,000 ft. | | | | | | | |
| 15,000 ft. | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 8

CASTLE AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|-----------|---------------------|--------------------------|--------------------|
| Runway 30 | 30 End | 145 | 348 |
| | 1,000 ft. | 149 | 355 |
| | 2,000 ft. | 151 | 354 |
| | 3,000 ft. | 151 | 351 |
| | 4,000 ft. | 169 | 359 |
| | 5,000 ft. | 154 | 351 |
| | 6,000 ft. | 152 | 354 |
| | 7,000 ft. | 148 | 358 |
| | 8,000 ft. | 156 | 366 |
| | 9,000 ft. | 163 | 361 |
| | 10,000 ft. | 161 | 353 |
| | 12 End | 183 | 405 |
| Taxiway 9 | 30 End | 100 | 196 |
| | 1,000 ft. | 92 | 204 |
| | 2,000 ft. | 96 | 200 |
| | 3,000 ft. | 99 | 201 |
| | 4,000 ft. | 94 | 201 |
| | 5,000 ft. | 99 | 201 |
| | 6,000 ft. | 97 | 202 |
| | 12 End | 98 | 195 |

TABLE 9
DOBBINS AIR FORCE BASE
ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R10 75' LH 39'9" | R10 Center Line 39'10" | R10 75' RH 39'1" | T10 31' LH See map | T10 Center Line See map | T10 31' RH See map | | |
|---------------------|------------------------|------------------------------|------------------------|--------------------------|-------------------------------|--------------------------|--|--|
| Run Location | | | | | | | | |
| Starting Point* | | | | | | | | |
| Cross Run Location | | | | | | | | |
| 1,000 ft. | 1,980 | 1,984 | 1,982 | 1,562 | 1,557 | 1,562 | | |
| 2,000 ft. | 3,992 | 3,985 | 3,993 | 3,568 | 3,569 | 3,568 | | |
| 3,000 ft. | 6,001 | 6,003 | 6,000 | 5,574 | 5,575 | 5,575 | | |
| 4,000 ft. | 8,012 | 8,018 | 8,015 | 7,584 | 7,581 | 7,582 | | |
| 5,000 ft. | 10,022 | 10,024 | 10,025 | 9,583 | 9,578 | 9,583 | | |
| 6,000 ft. | 12,032 | 12,036 | 12,033 | 11,600 | 11,596 | 11,597 | | |
| 7,000 ft. | 14,045 | 14,048 | 14,046 | 13,498 | 13,493 | 13,496 | | |
| 8,000 ft. | 16,053 | 16,055 | 16,055 | 15,618 | 15,611 | 15,617 | | |
| 9,000 ft. | 18,064 | 18,068 | 18,066 | 17,625 | 17,620 | 17,623 | | |
| 10,000 ft. | 20,062 | 20,046 | 20,048 | 19,235 | 19,226 | 19,228 | | |
| 11,000 ft. | | | | | | | | |
| 12,000 ft. | | | | | | | | |
| 13,000 ft. | | | | | | | | |
| 14,000 ft. | | | | | | | | |
| 15,000 ft. | | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 10

DOBBINS AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|------------|---------------------|--------------------------|--------------------|
| Runway 10 | 10 End | 298 | 608 |
| | 1,000 ft. | 266 | 531 |
| | 2,000 ft. | 266 | 538 |
| | 3,000 ft. | 265 | 535 |
| | 4,000 ft. | 266 | 541 |
| | 5,000 ft. | 267 | 533 |
| | 6,000 ft. | 263 | 530 |
| | 7,000 ft. | 264 | 534 |
| | 8,000 ft. | 264 | 529 |
| | 9,000 ft. | 263 | 531 |
| | 28 End | 294 | 592 |
| Taxiway 10 | West End | 75 | 128 |
| | 1,000 ft. | 40 | 110 |
| | 2,000 ft. | 50 | 103 |
| | 3,000 ft. | 51 | 109 |
| | 4,000 ft. | 50 | 104 |
| | 5,000 ft. | 49 | 105 |
| | 6,000 ft. | 49 | 106 |
| | 7,000 ft. | 55 | 111 |
| | 8,000 ft. | 49 | 109 |
| | 9,000 ft. | 48 | 104 |
| | East End | 61 | 118 |

TABLE 11
EDWARDS AIR FORCE BASE

ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R4 75' LH 50' | R4 Center Line 50' | R4 75' RH 50' | T-West 50' LH See map | T-West Center Line See map | T-West 50' RH See map | | | |
|---------------------|---------------------|--------------------------|---------------------|-----------------------------|----------------------------------|-----------------------------|--|--|--|
| Run Location | | | | | | | | | |
| Starting Point* | | | | | | | | | |
| Cross Run Location | | | | | | | | | |
| 1,000 ft. | 1,910 | 1,905 | 1,913 | 2,007 | 2,008 | 2,013 | | | |
| 2,000 ft. | 3,925 | 3,924 | 3,924 | 4,019 | 4,017 | 4,021 | | | |
| 3,000 ft. | 5,929 | 5,927 | 5,930 | 6,026 | 6,025 | 6,030 | | | |
| 4,000 ft. | 7,937 | 7,938 | 7,941 | 8,040 | 8,036 | 8,040 | | | |
| 5,000 ft. | 9,949 | 9,947 | 9,956 | 10,046 | 10,045 | 10,047 | | | |
| 6,000 ft. | 11,951 | 11,958 | 11,957 | | | | | | |
| 7,000 ft. | 13,958 | 13,962 | 13,965 | | | | | | |
| 8,000 ft. | 15,967 | 15,969 | 15,973 | | | | | | |
| 9,000 ft. | 17,975 | 17,977 | 17,983 | | | | | | |
| 10,000 ft. | 19,993 | 19,983 | 19,996 | | | | | | |
| 11,000 ft. | 21,990 | 21,991 | 22,003 | | | | | | |
| 12,000 ft. | 23,995 | 23,997 | 24,010 | | | | | | |
| 13,000 ft. | 26,002 | 26,003 | 26,019 | | | | | | |
| 14,000 ft. | 28,008 | 28,009 | 28,029 | | | | | | |
| 15,000 ft. | 30,015 | 30,020 | 30,037 | | | | | | |

*Distance from threshold lights to start of run.

TABLE 12

EDWARDS AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|--------------|---------------------|--------------------------|--------------------|
| Runway 4 | 4 End | 246 | 504 |
| | 1,000 ft. | 246 | 507 |
| | 2,000 ft. | 246 | 504 |
| | 3,000 ft. | 249 | 506 |
| | 4,000 ft. | 243 | 503 |
| | 5,000 ft. | 247 | 504 |
| | 6,000 ft. | 241 | 505 |
| | 7,000 ft. | 237 | 494 |
| | 8,000 ft. | 243 | 502 |
| | 9,000 ft. | 243 | 500 |
| | 10,000 ft. | 248 | 505 |
| | 11,000 ft. | 240 | 500 |
| | 12,000 ft. | 250 | 511 |
| | 13,000 ft. | 250 | 503 |
| | 14,000 ft. | 247 | 507 |
| | 35 End | 248 | 501 |
| West Taxiway | North End | 100 | 202 |
| | 1,000 ft. | 99 | 198 |
| | 2,000 ft. | 99 | 196 |
| | 3,000 ft. | 100 | 198 |
| | 4,000 ft. | 102 | 199 |
| | South End | 100 | 201 |

TABLE 14

ELLISWORTH AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|-----------|---------------------|--------------------------|--------------------|
| Runway 30 | 30 End | 245 | 481 |
| | 1,000 ft. | 245 | 464 |
| | 2,000 ft. | 211 | 464 |
| | 3,000 ft. | 258 | 479 |
| | 4,000 ft. | 235 | 474 |
| | 5,000 ft. | 233 | 468 |
| | 6,000 ft. | 232 | 466 |
| | 7,000 ft. | 241 | 482 |
| | 8,000 ft. | 253 | 500 |
| | 9,000 ft. | 248 | 500 |
| | 10,000 ft. | 237 | 482 |
| | 11,000 ft. | 232 | 475 |
| | 12,000 ft. | 235 | 477 |
| | 12 End | 242 | 489 |

TABLE 15

GEORGE AIR FORCE BASE

ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R16 | | R16 | | R3 | | R3 | | R3 | | T | | T | |
|---------------------|-------------|--------|--------|-------------|--------|--------|-------------|--------|--------|-------------|--------|--------|-------------|--------|
| Run Location | Center Line | 50' RH | 50' LH | Center Line | 50' RH | 50' LH | Center Line | 50' RH | 50' LH | Center Line | 50' RH | 50' LH | Center Line | 50' RH |
| Starting Point* | 25' | 25' | 25' | 25' | 25' | 25' | 25' | 25' | 25' | 25' | 25' | 25' | 25' | 25' |
| Cross Run Location | | | | | | | | | | | | | | |
| 1,000 ft. | 1,970 | 1,972 | 1,902 | 1,904 | 1,902 | 1,902 | 1,904 | 1,902 | 1,993 | 2,000 | 1,999 | | | |
| 2,000 ft. | 3,980 | 3,972 | 3,993 | 3,991 | 3,993 | 3,993 | 3,991 | 3,993 | 3,996 | 4,000 | 4,002 | | | |
| 3,000 ft. | 6,018 | 6,021 | 5,766 | 5,767 | 5,766 | 5,767 | 5,767 | 5,771 | 5,995 | 6,000 | 5,999 | | | |
| 4,000 ft. | 8,048 | 8,049 | 7,707 | 7,698 | 7,707 | 7,707 | 7,698 | 7,703 | 7,996 | 8,001 | 8,006 | | | |
| 5,000 ft. | 10,186 | 10,188 | 9,887 | 9,892 | 9,887 | 9,887 | 9,892 | 9,895 | 9,991 | 10,000 | 9,999 | | | |
| 6,000 ft. | 12,112 | 12,112 | 11,942 | 11,950 | 11,942 | 11,942 | 11,950 | 11,955 | 10,630 | 10,641 | 10,241 | | | |
| 7,000 ft. | 14,150 | 14,150 | 13,975 | 13,978 | 13,975 | 13,975 | 13,978 | 13,990 | | | | | | |
| 8,000 ft. | 16,191 | 16,193 | 16,035 | 16,034 | 16,035 | 16,035 | 16,034 | 16,050 | | | | | | |
| 9,000 ft. | 18,183 | 18,185 | 18,280 | 18,275 | 18,280 | 18,280 | 18,275 | 18,292 | | | | | | |
| 10,000 ft. | 20,134 | 20,128 | | | | | | | | | | | | |
| 11,000 ft. | | | | | | | | | | | | | | |
| 12,000 ft. | | | | | | | | | | | | | | |
| 13,000 ft. | | | | | | | | | | | | | | |
| 14,000 ft. | | | | | | | | | | | | | | |
| 15,000 ft. | | | | | | | | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 16
GEORGE AIR FORCE BASE
CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|-----------|---------------------|--------------------------|--------------------|
| Runway 16 | 16 End | 102 | 202 |
| | 1,000 ft. | 100 | 186 |
| | 2,000 ft. | 100 | 198 |
| | 3,000 ft. | 100 | 190 |
| | 4,000 ft. | 99 | 192 |
| | 5,000 ft. | 97 | 212 |
| | 6,000 ft. | 92 | 202 |
| | 7,000 ft. | 106 | 213 |
| | 8,000 ft. | 115 | 215 |
| | 9,000 ft. | 105 | 215 |
| | 34 End | 109 | 226 |
| Runway 3 | 3 End | 131 | 273 |
| | 1,000 ft. | 112 | 241 |
| | 2,000 ft. | 110 | 245 |
| | 3,000 ft. | 112 | 246 |
| | 4,000 ft. | 111 | 249 |
| | 5,000 ft. | 111 | 246 |
| | 6,000 ft. | 112 | 246 |
| | 7,000 ft. | 109 | 244 |
| | 8,000 ft. | 111 | 246 |
| | 21 End | 110 | 249 |
| Taxiway 5 | | 50 | 108 |
| | 1,000 ft. | 49 | 110 |
| | 2,000 ft. | 51 | 108 |
| | 3,000 ft. | 52 | 108 |
| | 4,000 ft. | 51 | 107 |
| | | 49 | 107 |

TABLE 17
GLASGOW AIR FORCE BASE
ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | RLO | RLO | TLO | TLO | TLO | TLO | TLO |
|---------------------|--------|-------------|---------|-------------|---------|-----|-----|
| Run Location | 75' LH | Center Line | 35' LH | Center Line | 35' RH | | |
| Starting Point* | 40' | 40' | See map | See map | See map | | |
| Cross Run Location | | | | | | | |
| 1,000 ft. | 2,451 | 2,457 | 2,007 | 2,008 | 2,010 | | |
| 2,000 ft. | 4,466 | 4,467 | 4,018 | 4,014 | 4,013 | | |
| 3,000 ft. | 6,467 | 6,467 | 6,027 | 6,022 | 6,027 | | |
| 4,000 ft. | 8,482 | 8,501 | 8,033 | 8,030 | 8,035 | | |
| 5,000 ft. | 10,496 | 10,496 | 10,041 | 9,992 | 10,042 | | |
| 6,000 ft. | 12,496 | 12,494 | 12,008 | 12,047 | 12,028 | | |
| 7,000 ft. | 14,525 | 14,517 | 14,069 | 14,061 | 14,061 | | |
| 8,000 ft. | 16,532 | 16,533 | 16,078 | 16,101 | 16,077 | | |
| 9,000 ft. | 18,521 | 18,521 | 18,110 | 18,114 | 18,118 | | |
| 10,000 ft. | 20,539 | 20,539 | 20,128 | 20,116 | 20,129 | | |
| 11,000 ft. | 22,546 | 22,545 | 22,142 | | 22,140 | | |
| 12,000 ft. | 24,543 | 24,543 | | | | | |
| 13,000 ft. | 26,950 | 26,990 | | | | | |
| 14,000 ft. | | | | | | | |
| 15,000 ft. | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 18

GLASGOW AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|------------|---------------------|--------------------------|--------------------|
| Runway 10 | 10 End | 249 | 392 |
| | 1,000 ft. | 246 | 497 |
| | 2,000 ft. | 251 | 500 |
| | 3,000 ft. | 251 | 499 |
| | 4,000 ft. | 252 | 502 |
| | 5,000 ft. | 234 | 472 |
| | 6,000 ft. | 179 | 363 |
| | 7,000 ft. | 170 | 365 |
| | 8,000 ft. | 166 | 360 |
| | 9,000 ft. | 200 | 380 |
| | 10,000 ft. | 164 | 331 |
| | 11,000 ft. | 167 | 348 |
| | 12,000 ft. | 177 | 368 |
| | 28 End | 162 | 342 |
| Taxiway 10 | 10 End | 69 | 140 |
| | 1,000 ft. | 61 | 125 |
| | 2,000 ft. | 61 | 126 |
| | 3,000 ft. | 63 | 127 |
| | 4,000 ft. | 69 | 145 |
| | 5,000 ft. | 58 | 122 |
| | 6,000 ft. | 57 | 122 |
| | 7,000 ft. | 57 | 121 |
| | 8,000 ft. | 59 | 122 |
| | 9,000 ft. | 60 | 121 |
| | 10,000 ft. | 60 | 122 |
| | 28 End | 62 | 125 |

TABLE 19
 LANGLEY AIR FORCE BASE
 ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R7 | R7 | R7 | R35 | R35 | R35 | R35 |
|---------------------|--------|-------------|----------|--------|-------------|--------|-----|
| Run Location | 50' LH | Center Line | 50' RH | 50' LH | Center Line | 50' RH | |
| Starting Point* | 19' | 18'2" | 32'2" | 66' | 55'10" | 59'6" | |
| Cross Run Location | | | | | | | |
| 1,000 ft. | 1,965 | 1,962 | 1,965 | 1,933 | 1,951 | 1,962 | |
| 2,000 ft. | 3,669 | 3,672 | 3,658 | 3,940 | 3,955 | 3,954 | |
| 3,000 ft. | 6,214 | 6,219 | 6,207 | 5,942 | 5,969 | 5,953 | |
| 4,000 ft. | 7,999 | 8,003 | 7,994 | 7,952 | 7,974 | 7,964 | |
| 5,000 ft. | 10,001 | 10,003 | 9,987 | 9,990 | 10,008 | 9,993 | |
| 6,000 ft. | 12,023 | 12,027 | 12,021 | | | | |
| 7,000 ft. | 14,019 | 14,021 | 14,010 | | | | |
| 8,000 ft. | 15,955 | 15,960 | 15,950 | | | | |
| 9,000 ft. | 18,039 | 18,052 | 18,035 | | | | |
| 10,000 ft. | 20,021 | 20,031 | 18,988** | | | | |
| 11,000 ft. | | | | | | | |
| 12,000 ft. | | | | | | | |
| 13,000 ft. | | | | | | | |
| 14,000 ft. | | | | | | | |
| 15,000 ft. | | | | | | | |

*Distance from threshold lights to start of run.
 **Short run due to construction work.

TABLE 20

LANGLEY AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|-----------|---------------------|--------------------------|--------------------|
| Runway 7 | 7 End | 106 | 237 |
| | 1,000 ft. | 120 | 241 |
| | 2,000 ft. | 109 | 222 |
| | 3,000 ft. | 111 | 233 |
| | 4,000 ft. | 113 | 239 |
| | 5,000 ft. | 112 | 233 |
| | 6,000 ft. | 108 | 223 |
| | 7,000 ft. | 105 | 221 |
| | 8,000 ft. | 104 | 219 |
| | 9,000 ft. | 113 | 241 |
| | 25 End | 111 | 227 |
| Runway 35 | 35 End | 116 | 237 |
| | 1,000 ft. | 106 | 228 |
| | 2,000 ft. | 110 | 234 |
| | 3,000 ft. | 104 | 233 |
| | 4,000 ft. | 109 | 232 |
| | 5,000 ft. | 113 | 233 |
| | 17 End | 101 | 225 |

TABLE 21

LARSON AIR FORCE BASE

ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R32 | R32 | T4 | T4 | T4 | T3 | T3 | T3 | T3 |
|---------------------|--------|-------------|--------|---------|-------------|---------|---------|-------------|---------|
| Run Location | 75' LH | Center Line | 75' RH | 35' LH | Center Line | 35' RH | 37' LH | Center Line | 37' RH |
| Starting Point* | 40' | 40' | 40' | See map | See map | See map | See map | See map | See map |
| Cross Run Location | | | | | | | | | |
| 1,000 ft. | 2,450 | 2,443 | 2,451 | 2,093 | 2,092 | 2,093 | 1,996 | 1,994 | 1,995 |
| 2,000 ft. | 4,472 | 4,459 | 4,481 | 4,098 | 4,098 | 4,099 | 3,989 | 3,981 | 3,990 |
| 3,000 ft. | 6,478 | 6,469 | 6,480 | 6,123 | 6,126 | 6,124 | 5,953 | 5,974 | 5,990 |
| 4,000 ft. | 8,484 | 8,475 | 8,483 | | | | 7,977 | 7,965 | 7,973 |
| 5,000 ft. | 10,497 | 10,484 | 10,500 | | | | 9,970 | 9,957 | 9,965 |
| 6,000 ft. | 12,504 | 12,485 | 12,505 | | | | 11,961 | 11,950 | 11,965 |
| 7,000 ft. | 14,518 | 14,496 | 14,529 | | | | 13,955 | 13,946 | 13,962 |
| 8,000 ft. | 16,543 | 16,521 | 16,545 | | | | | | |
| 9,000 ft. | 18,560 | 18,535 | 18,563 | | | | | | |
| 10,000 ft. | 20,570 | 20,544 | 20,571 | | | | | | |
| 11,000 ft. | 22,572 | 22,547 | 22,581 | | | | | | |
| 12,000 ft. | 24,594 | 24,560 | 24,608 | | | | | | |
| 13,000 ft. | 27,033 | 27,002 | 27,046 | | | | | | |
| 14,000 ft. | | | | | | | | | |
| 15,000 ft. | | | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 22

LARSON AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|-----------|---------------------|--------------------------|--------------------|
| Runway 32 | 32 End | 236 | 478 |
| | 1,000 ft. | 255 | 501 |
| | 2,000 ft. | 264 | 505 |
| | 3,000 ft. | 259 | 501 |
| | 4,000 ft. | 245 | 506 |
| | 5,000 ft. | 260 | 503 |
| | 6,000 ft. | 230 | 505 |
| | 7,000 ft. | 231 | 501 |
| | 8,000 ft. | 237 | 499 |
| | 9,000 ft. | 213 | 478 |
| | 10,000 ft. | 215 | 453 |
| | 11,000 ft. | 213 | 447 |
| | 12,000 ft. | 229 | 476 |
| | 14 End | 243 | 512 |
| Taxiway 4 | South End | 67 | 149 |
| | 1,000 ft. | 64 | 149 |
| | 2,000 ft. | 71 | 148 |
| | North End | 71 | 143 |
| Taxiway 3 | South End | 74 | 156 |
| | 1,000 ft. | 74 | 149 |
| | 2,000 ft. | 75 | 151 |
| | 3,000 ft. | 75 | 152 |
| | 4,000 ft. | 75 | 151 |
| | 5,000 ft. | 74 | 151 |
| | 6,000 ft. | 75 | 157 |
| | North End | 75 | 150 |

TABLE 23

MATHER AIR FORCE BASE

ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R22L | R22L | R22L | T22 | T22 | T22 | T22 |
|---------------------|-------------|--------|---------|-------------|---------|---------|-----|
| Run Location | Center Line | 75' RH | 75' LH | Center Line | 75' RH | 75' RH | |
| Starting Point* | 34'7" | 24'4" | See map | See map | See map | See map | |
| Cross Run Location | | | | | | | |
| 1,000 ft. | 2,249 | 2,265 | 2,003 | 2,007 | 2,012 | 2,012 | |
| 2,000 ft. | 4,252 | 4,291 | 4,011 | 4,018 | 4,013 | 4,013 | |
| 3,000 ft. | 6,275 | 6,291 | 6,019 | 6,024 | 6,030 | 6,030 | |
| 4,000 ft. | 8,287 | 8,302 | 8,054 | 8,035 | 8,041 | 8,041 | |
| 5,000 ft. | 10,298 | 10,306 | 10,040 | 10,043 | 10,050 | 10,050 | |
| 6,000 ft. | 12,308 | 12,336 | 12,042 | 12,052 | 12,060 | 12,060 | |
| 7,000 ft. | 14,315 | 14,323 | 14,049 | 14,059 | 14,063 | 14,063 | |
| 8,000 ft. | 16,318 | 16,325 | 16,059 | 16,070 | 16,072 | 16,072 | |
| 9,000 ft. | 18,331 | 18,333 | 18,066 | 18,078 | 18,077 | 18,077 | |
| 10,000 ft. | 20,339 | 20,347 | 19,480 | 19,486 | 19,490 | 19,490 | |
| 11,000 ft. | 22,634 | 22,641 | | | | | |
| 12,000 ft. | | | | | | | |
| 13,000 ft. | | | | | | | |
| 14,000 ft. | | | | | | | |
| 15,000 ft. | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 24

MATHER AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|------------|---------------------|--------------------------|--------------------|
| Runway 22L | 22L End | 248 | 505 |
| | 1,000 ft. | 254 | 491 |
| | 2,000 ft. | 177 | 484 |
| | 3,000 ft. | 233 | 445 |
| | 4,000 ft. | 252 | 490 |
| | 5,000 ft. | 248 | 509 |
| | 6,000 ft. | 233 | 463 |
| | 7,000 ft. | 233 | 421 |
| | 8,000 ft. | 221 | 471 |
| | 9,000 ft. | 238 | 460 |
| | 10,000 ft. | 232 | 476 |
| | 4R End | 237 | 461 |
| Taxiway 22 | 22 End | 148 | 305 |
| | 1,000 ft. | 153 | 310 |
| | 2,000 ft. | 148 | 303 |
| | 3,000 ft. | 149 | 304 |
| | 4,000 ft. | 153 | 310 |
| | 5,000 ft. | 144 | 300 |
| | 6,000 ft. | 147 | 301 |
| | 7,000 ft. | 147 | 302 |
| | 8,000 ft. | 144 | 300 |
| | 9,000 ft. | 145 | 301 |
| | 4 End | 145 | 303 |

TABLE 25
McGUIRE AIR FORCE BASE
ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R12 75' LH 40' | R12 Center Line 42'5" | R12 75' RH 43'5" | T5 31' LH See Map | T5 Center Line See Map | T5 31' RH See Map |
|---------------------|----------------------|-----------------------------|------------------------|-------------------------|------------------------------|-------------------------|
| Run Location | | | | | | |
| Starting Point* | | | | | | |
| Cross Run Location | | | | | | |
| 1,000 ft. | 2,885 | 2,880 | 2,881 | 1,405 | 1,396 | 1,409 |
| 2,000 ft. | 4,497 | 4,491 | 4,503 | 3,426 | 3,422 | 3,430 |
| 3,000 ft. | 6,561 | 6,542 | 6,562 | 5,441 | 5,429 | 5,436 |
| 4,000 ft. | 8,629 | 8,617 | 8,631 | 7,433 | 7,426 | 7,435 |
| 5,000 ft. | 10,699 | 10,683 | 10,695 | 9,434 | 9,429 | 9,439 |
| 6,000 ft. | 12,748 | 12,731 | 12,749 | 11,450 | 11,448 | 11,458 |
| 7,000 ft. | 14,941 | 15,054 | 14,930 | 12,757 | 12,754 | 12,761 |
| 8,000 ft. | | | | | | |
| 9,000 ft. | | | | | | |
| 10,000 ft. | | | | | | |
| 11,000 ft. | | | | | | |
| 12,000 ft. | | | | | | |
| 13,000 ft. | | | | | | |
| 14,000 ft. | | | | | | |
| 15,000 ft. | | | | | | |

*Distance from threshold lights to start of run.

TABLE 26

McGUIRE AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|-----------|---------------------|--------------------------|--------------------|
| Runway 12 | 12 End | 109 | 223 |
| | 1,000 ft. | 140 | 288 |
| | 2,000 ft. | 140 | 287 |
| | 3,000 ft. | 141 | 288 |
| | 4,000 ft. | 128 | 277 |
| | 5,000 ft. | 139 | 283 |
| | 6,000 ft. | 137 | 287 |
| | 30 End | 131 | 287 |
| Taxiway 5 | 24 End | 48 | 105 |
| | 1,000 ft. | 48 | 113 |
| | 2,000 ft. | 50 | 112 |
| | 3,000 ft. | 49 | 114 |
| | 4,000 ft. | 49 | 115 |
| | 5,000 ft. | 50 | 121 |
| | 6,000 ft. | 49 | 116 |
| | 6 End | 48 | 114 |

TABLE 27

USAF PLANT NO. 42
FAIRDALE

ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R7 | R7 | R7 | T-B (2) | T-B (2) | T-B (2) | T-B (2) | T-N (14) | T-N |
|---------------------|--------|-------------|--------|---------|-------------|---------|-------------|-------------|-----|
| Run Location | 50' LH | Center Line | 50' RH | 35' LH | Center Line | 35' RH | Center Line | Center Line | |
| Starting Point* | 25' | 25' | 25' | See map | See map | See map | See map | See map | |
| Cross Run Location | | | | | | | | | |
| 1,000 ft. | 1,961 | 1,965 | 1,964 | 2,000 | 2,000 | 2,007 | 2,000 | | |
| 2,000 ft. | 3,969 | 3,976 | 3,982 | 4,001 | 4,001 | 4,000 | 4,002 | | |
| 3,000 ft. | 5,959 | 5,968 | 5,967 | 6,002 | 6,001 | 6,000 | | | |
| 4,000 ft. | 7,976 | 7,974 | 7,980 | 8,002 | 8,001 | 8,003 | | | |
| 5,000 ft. | 9,989 | 9,988 | 9,988 | 10,005 | 10,000 | 10,000 | | | |
| 6,000 ft. | 11,990 | 11,997 | 12,004 | 12,005 | 12,001 | 12,001 | | | |
| 7,000 ft. | 14,008 | 14,007 | 14,006 | 14,000 | 14,000 | 14,000 | | | |
| 8,000 ft. | 16,016 | 16,016 | 16,018 | 16,009 | 16,000 | 16,001 | | | |
| 9,000 ft. | 18,034 | 18,036 | 18,042 | 18,008 | 18,005 | 18,006 | | | |
| 10,000 ft. | 20,034 | 20,034 | 20,035 | 20,000 | 20,000 | 19,998 | | | |
| 11,000 ft. | 22,046 | 22,044 | 22,045 | 22,001 | 22,001 | 22,003 | | | |
| 12,000 ft. | 24,024 | 24,022 | 24,027 | 23,357 | 23,347 | 23,365 | | | |
| 13,000 ft. | | | | | | | | | |
| 14,000 ft. | | | | | | | | | |
| 15,000 ft. | | | | | | | | | |

*Distance from threshold lights to start of r.c.

TABLE 28

USAF PLANT NO. 42

FAIRDALE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|---------------|---------------------|--------------------------|--------------------|
| Runway 7 | 7 End | 199 | 350 |
| | 1,000 ft. | 155 | 310 |
| | 2,000 ft. | 155 | 331 |
| | 3,000 ft. | 155 | 340 |
| | 4,000 ft. | 154 | 343 |
| | 5,000 ft. | 153 | 329 |
| | 6,000 ft. | 147 | 321 |
| | 7,000 ft. | 154 | 324 |
| | 8,000 ft. | 148 | 321 |
| | 9,000 ft. | 152 | 317 |
| | 10,000 ft. | 153 | 339 |
| | 11,000 ft. | 140 | 322 |
| | 25 End | 175 | 370 |
| Taxiway B(7) | 25 End | 74 | 197 |
| | 1,000 ft. | 65 | 139 |
| | 2,000 ft. | 71 | 146 |
| | 3,000 ft. | 75 | 145 |
| | 4,000 ft. | 73 | 146 |
| | 5,000 ft. | 74 | 145 |
| | 6,000 ft. | 71 | 145 |
| | 7,000 ft. | 72 | 146 |
| | 8,000 ft. | 72 | 145 |
| | 9,000 ft. | 72 | 145 |
| | 10,000 ft. | 71 | 145 |
| | 11,000 ft. | 73 | 145 |
| | 7 End | 74 | 147 |
| Taxiway N(14) | 7 - 25 End | 75 | 173 |
| | 1,000 ft. | 76 | 170 |
| | Site 3 End | 75 | 148 |

TABLE 29

SEWART AIR FORCE BASE

ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R14 | R14 | R14 | R18 | R18 | R18 | R18 | R18 | T2 | T2 | T2 |
|---------------------|--------|-------------|--------|--------|-------------|--------|--------|-------------|---------|-------------|--------|
| Run Location | 75' IH | Center Line | 75' RH | 75' IH | Center Line | 75' RH | 75' IH | Center Line | T2 | Center Line | T2 |
| Starting Point* | 45' 4" | 37' 3" | 47' 8" | 23' | 24' 4" | 24' | 35' IH | See map | See map | See map | 35' RH |
| Cross Run Location | | | | | | | | | | | |
| 1,000 ft. | 2,004 | 2,012 | 1,999 | 1,970 | 1,963 | 1,968 | 2,001 | 2,010 | 2,003 | | |
| 2,000 ft. | 4,025 | 4,022 | 4,018 | 3,983 | 3,976 | 3,987 | 4,008 | 4,021 | 4,009 | | |
| 3,000 ft. | 6,012 | 6,006 | 6,002 | 6,000 | 5,989 | 5,998 | 6,015 | 6,032 | 6,026 | | |
| 4,000 ft. | 7,855 | 7,851 | 7,844 | 8,004 | 7,994 | 8,014 | 8,022 | 8,039 | 8,026 | | |
| 5,000 ft. | 10,036 | 9,982 | 10,005 | 10,019 | 10,011 | 10,017 | | | | | |
| 6,000 ft. | 11,629 | 11,591 | 11,622 | | | | | | | | |
| 7,000 ft. | 13,641 | 13,607 | 13,653 | | | | | | | | |
| 8,000 ft. | 15,873 | 15,831 | 15,855 | | | | | | | | |
| 9,000 ft. | | | | | | | | | | | |
| 10,000 ft. | | | | | | | | | | | |
| 11,000 ft. | | | | | | | | | | | |
| 12,000 ft. | | | | | | | | | | | |
| 13,000 ft. | | | | | | | | | | | |
| 14,000 ft. | | | | | | | | | | | |
| 15,000 ft. | | | | | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 30

SEWART AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|-----------|---------------------|--------------------------|--------------------|
| Runway 14 | 14 End | 217 | 438 |
| | 1,000 ft. | 195 | 404 |
| | 2,000 ft. | 200 | 405 |
| | 3,000 ft. | 226 | 451 |
| | 4,000 ft. | 220 | 446 |
| | 5,000 ft. | 253 | 499 |
| | 6,000 ft. | 238 | 485 |
| | 7,000 ft. | 257 | 507 |
| | 32 End | 282 | 515 |
| Runway 18 | 18 End | 265 | 539 |
| | 1,000 ft. | 266 | 529 |
| | 2,000 ft. | 266 | 537 |
| | 3,000 ft. | 267 | 530 |
| | 4,000 ft. | 264 | 530 |
| | 5,000 ft. | 263 | 532 |
| | 36 End | 266 | 431 |
| Taxiway 2 | North End | 72 | 150 |
| | 1,000 ft. | 72 | 147 |
| | 2,000 ft. | 73 | 153 |
| | 3,000 ft. | 66 | 151 |
| | South End | 68 | 150 |

TABLE 31

SHAW AIR FORCE BASE

ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R4 | R4 | R4 | T | T | T | T |
|---------------------|---------|-------------|--------|---------|-------------|---------|---|
| Run Location | 50' LH | Center Line | 50' RH | 35' LH | Center Line | 35' RH | |
| Starting Point* | 26' 11" | 24' | 23' 8" | See map | See map | See map | |
| Cross Run Location | | | | | | | |
| 1,000 ft. | 1,988 | 1,995 | 1,991 | 1,997 | 2,004 | 2,014 | |
| 2,000 ft. | 3,999 | 4,002 | 3,998 | 4,001 | 4,012 | 4,021 | |
| 3,000 ft. | 5,992 | 5,983 | 5,999 | 5,703 | 5,716 | 5,735 | |
| 4,000 ft. | 7,940 | 7,925 | 7,940 | | | | |
| 5,000 ft. | 10,010 | 10,001 | 10,018 | | | | |
| 6,000 ft. | 12,021 | 12,013 | 12,030 | | | | |
| 7,000 ft. | 14,033 | 14,019 | 14,037 | | | | |
| 8,000 ft. | 16,044 | 16,034 | 16,054 | | | | |
| 9,000 ft. | 18,045 | 18,030 | 18,045 | | | | |
| 10,000 ft. | 20,054 | 20,044 | 20,055 | | | | |
| 11,000 ft. | | | | | | | |
| 12,000 ft. | | | | | | | |
| 13,000 ft. | | | | | | | |
| 14,000 ft. | | | | | | | |
| 15,000 ft. | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 32

SHAW AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|----------|---------------------|--------------------------|--------------------|
| Runway 4 | 4 End | 131 | 241 |
| | 1,000 ft. | 106 | 211 |
| | 2,000 ft. | 111 | 214 |
| | 3,000 ft. | 107 | 211 |
| | 4,000 ft. | 109 | 218 |
| | 5,000 ft. | 105 | 215 |
| | 6,000 ft. | 102 | 211 |
| | 7,000 ft. | 106 | 230 |
| | 8,000 ft. | 108 | 212 |
| | 9,000 ft. | 103 | 211 |
| | 22 End | 112 | 214 |
| Taxiway | South End | 75 | 147 |
| | 1,000 ft. | 74 | 143 |
| | 2,000 ft. | 75 | 149 |
| | North End | 77 | 146 |

TABLE 33

TRAVIS AIR FORCE BASE

ODOMETER COUNT AT CROSS RUN LOCATIONS

| Surface Designation | R2LR 75' LH 40' | R2LR Center Line 40' | R2LR 75' RH 40' | | | | | | |
|---------------------|-----------------------|----------------------------|-----------------------|--|--|--|--|--|--|
| Run Location | | | | | | | | | |
| Starting Point* | | | | | | | | | |
| Cross Run Location | | | | | | | | | |
| 1,000 ft. | 2,001 | 2,001 | 2,001 | | | | | | |
| 2,000 ft. | 4,004 | 4,004 | 4,004 | | | | | | |
| 3,000 ft. | 6,005 | 6,003 | 6,003 | | | | | | |
| 4,000 ft. | 8,007 | 8,007 | 8,007 | | | | | | |
| 5,000 ft. | 10,023 | 10,019 | 10,024 | | | | | | |
| 6,000 ft. | 12,031 | 12,020 | 12,031 | | | | | | |
| 7,000 ft. | 14,036 | 14,034 | 14,034 | | | | | | |
| 8,000 ft. | 16,053 | 16,052 | 16,052 | | | | | | |
| 9,000 ft. | 18,058 | 18,053 | 18,053 | | | | | | |
| 10,000 ft. | 20,082 | 20,062 | 20,063 | | | | | | |
| 11,000 ft. | 22,060 | 22,040 | 22,042 | | | | | | |
| 12,000 ft. | | | | | | | | | |
| 13,000 ft. | | | | | | | | | |
| 14,000 ft. | | | | | | | | | |
| 15,000 ft. | | | | | | | | | |

*Distance from threshold lights to start of run.

TABLE 34

TRAVIS AIR FORCE BASE

CROSS RUN INFORMATION

| | <u>Run Location</u> | <u>Center Line Count</u> | <u>Final Count</u> |
|------------|---------------------|--------------------------|--------------------|
| Runway 21R | 21R End | 233 | 491 |
| | 1,000 ft. | 243 | 484 |
| | 2,000 ft. | 247 | 501 |
| | 3,000 ft. | 226 | 464 |
| | 4,000 ft. | 238 | 470 |
| | 5,000 ft. | 209 | 450 |
| | 6,000 ft. | 218 | 465 |
| | 7,000 ft. | 212 | 452 |
| | 8,000 ft. | 198 | 435 |
| | 9,000 ft. | 207 | 442 |
| | 10,000 ft. | 222 | 449 |
| | 3L End | 215 | 438 |

APPENDIX V

POWER SPECTRAL DENSITY CALCULATIONS

The power spectral density (PSD) characteristics of the runways have been calculated in the usual manner as the Fourier transform of the autocovariance functions. This procedure is described in the literature and, therefore, will only be outlined here.

$$y'_n = y_{n+1} - y_n \quad (1)$$

$$y'(x) = y(x) - y(x-\Delta x) \quad (2)$$

This operation of "prewhitening" is equivalent to multiplying the power spectrum by the function

$$F(h\Delta\Omega) = 1 - e^{-j(h\Delta\Omega)\Delta x} \quad (3)$$

$$F(\Omega) = 1 - e^{-j\Omega\Delta x} \quad (4)$$

Next, the mean lagged products R_p were determined:

$$R_p = \frac{1}{n-p} \sum_{q=1}^{n-p} y'_q y'_{q+p} - \frac{1}{(n-p)^2} \sum_{q=1}^{n-p} y'_q \sum_{q=1}^{n-p} y'_{q+p} \quad (5)$$

$$\begin{aligned} R(p+\Delta x) &= \frac{1}{(n-p)\Delta x} \int_0^{(n-p)\Delta x} y'(x) y'(x+p\Delta x) dx \\ &- \frac{1}{(n-p)^2 \Delta x^2} \int_0^{(n-p)\Delta x} y'(x) dx \int_0^{(n-p)\Delta x} y'(x+p\Delta x) dx \end{aligned} \quad (6)$$

This function $R(p+\Delta x)$ or R_p is also known as the autocovariance function. The number n is equal to the total number of values y'_q . R_p has been calculated for all values of p ranging from zero to m where m is determined by:

$$m = \frac{n}{30.75} \quad (7)$$

Next the "raw" estimates of the PSD have been formed.

$$L_h = \frac{2\Delta x}{n} \sum_{p=0}^m \epsilon_p R_p \cos \frac{hpn}{m} \begin{cases} h = (0, 1, 2, \dots, m) \\ \epsilon_p = 1 ; 0 < p < m \\ \epsilon_p = 1/2 ; p = 0 \text{ or } m \end{cases} \quad (8)$$

$$L(h\Delta\Omega) = \frac{2}{\pi} \int_0^{\infty} R(p) \cos(h\Delta\Omega p) dp \quad (9)$$

The next operation is to form the "smoothed" estimates of the PSD.

$$\phi_h = \frac{1}{2} L_0 + \frac{1}{2} L_1, \quad h = 0 \quad (10)$$

$$\phi_h = \frac{1}{4} L_{h-1} + \frac{1}{2} L_h + \frac{1}{4} L_{h+1}, \quad 1 \leq h \leq m-1 \quad (11)$$

$$\phi_h = \frac{1}{2} L_{m-1} + \frac{1}{2} L_m, \quad h = 0 \quad (12)$$

$$\phi(h\Delta\Omega) = \frac{1}{4} L[(h-1)\Delta\Omega] + \frac{1}{2} L(h\Delta\Omega) + \frac{1}{4} L[(h+1)\Delta\Omega] \quad (13)$$

The last operation is to remove the effects of the "prewhitening" operation by dividing:

$$\phi_h \text{ by } |F(h\Delta\Omega)|^2 = 2(1 - \cos h\Delta\Omega\Delta x) \quad (14)$$

$$\phi(h\Delta\Omega) \text{ by } |F(\Omega)|^2 = 2(1 - \cos \Omega\Delta x) \quad (15)$$

Aeronautical Systems Division, AF Flight
Dynamics Lab, Wright-Patterson AFB, Ohio.

Rep No. WADD-TR-60-410, 1-111, AIR MAIL
RUNWAY PROFILE MEASURING INSTRUMENTATION AND
RUNWAY PROPERTIES: Part III - Data Summary
Final Report, Jul 63. 24p. 11 refs. 11 illus.,
tables, 5 refs.

Uninspected

The profiles of the runways and taxiways of
17 Air Force bases collected at runway ends
all sections of the runways and taxiways
were measured using special measuring equipment.

(over)

surveying instrument used. The Aeronautical
Systems Division requires this data for
all types of surfaces in the development
a landing gear design criterion for all
flight vehicles. Profiles of runways and
results of a statistical analysis of the data
are appended.

Aeronautical Systems Division, AF Flight
Dynamics Lab, Wright-Patterson AFB, Ohio.

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Aeronautical Systems Division, AF Flight
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Ref No. WADD-TR-50-470, Part III, AIRWAY
RUNWAY PROFILE MEASURING INSTRUMENTATION AND
RUNWAY PROPERTIES: Part III - Runway
Final Report, Jul 63. 111 p. Includes
tables, 3 refs.

Unpublished.

The profiles of the runway and taxiway
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all sections of the command. The data
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(over)

surveying instrumentation. The Aeronautical
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flight vehicles. Profiles of the
surveys of a steady level velocity of
are appended.

Aeronautical Systems Division, AF Flight
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Ref No. WADD-TR-60-470, P. 111, AERONAUTICAL
SYSTEMS DIVISION, WRIGHT-PATTERSON AFB, OHIO.
RUNWAY PROFILES MEASURING INSTRUMENTATION AND
DATA PROPERTIES: Part III - Data Summary.
Final Report, Jul 63. 21p. Incl. 11 illus.,
tables, 3 refs.

On Profile

The profiles of the runway and the
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(over)

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Aeronautical Systems Division, AF Flight
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Ref No. WADD-TR-56-470, P. II, AERONAUTICAL
SYSTEMS DIVISION, AF FLIGHT DYNAMICS LAB,
RWYWAY PROFILE MEASURING INSTRUMENTATION AND
RWYWAY PROPERTIES: Part II - Data Summary,
Final Report, Jul 63. 211. 211. 211. 211.
tables, 3 refs.

UNCLASSIFIED

The profiles of the runways and taxiways
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(over)

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